ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXLI. No. 3639 AUGUST 22, 1947 9d. WEEKLY

Men, Materials and Power

Co-ordination to Solve Economic Problems

PARLIAMENT has adjourned for the long summer recess in the middle of a serious economic situation after its long discussion of the subject. Little is known as yet of the steps which the Government intends to take to redress our adverse international balance but it is agreed by all parties and sections that remedies can only be found by the raising of the labour force to the highest possible level, by seeing that that force is used in the right directions and by inducing everybody in it to produce his or her utmost.

Control of Labour

So far the only positive step has been to revive, or extend, as from October 1st the Control of Engagement Order, which has continued to apply in the mining, agricultural and building and civil engineering industries. This Order will prevent the departure from the scheduled industries of men between 18 and 50 and women between 18 and 40, a provision which guards against depletion of the workers in those industries but does not increase the numbers. Increase will only be obtained in a more or less haphazard fashion by the direction into these industries of people who leave other occupations.

It thus becomes necessary to offer inducements to these men and women to leave work which, at the present time, is unimportant and enter establishments which are contributing to national recovery. This movement may possibly be hastened by careful discrimination in the distribution of materials, so as to curtail non-essential production. This is unfortunately necessary and only to be tolerated while the nation is in its present straits. But the withholding of materials will affect the really non-essential " industries " to a very small extent and further measures of direction may be thought necessary.

It was announced last week that the number engaged in production for the home market and the Forces decreased by 8 per cent in June last while those producing for export increased by 25 per cent. This turnover indicates that much is being done to rectify the situation.

The supply of raw materials is still unsatisfactory. We are only one of the nations participating in a scramble for much-reduced quantities and, as with labour, we must ensure that our limited quota is allocated to the best advantage. As we have said, this allocation will also have an effect upon the movement of labour and in this way intensify the demand from the essential industries.

Relieving Generating Plant

Men and materials cannot be used effectively unless an adequate and reliable supply of power is available. Coal is not yet reaching industry in the necessary volume and electric power output will not be sufficient for all needs for at least three years. Serious steps are now being taken to ensure that industry will not again be dislocated by sudden stoppages of electricity supply. Various methods of preventing the load from reaching peaks impossible to cope with are still being studied. Whatever arrangement is adopted will be inconvenient, to say the least, but there

is no doubt that both industrialists and their employees now have a full realization of the need and intend to bear this additional burden with what extra fortitude they can call up.

At the same time non-industrial consumers have a responsibility. Industrial load-spreading is not expected to result in fuel economy; it is the commercial and domestic users who must bring this about under the guidance of the supply authorities. In this and in all the other matters which we have mentioned we feel that the people will respond if they are given a clear idea of what is expected of them instead of being threatened with disaster if they do not do an undefined something or other.

Power Plant Exports

THE July "Digest of Statistics" shows that in the first three months of this year deliveries of steam turbo-alternators rated at 10,000 kW or over amounted to 261,500 kW of which almost half (129,000 kW) were exported. In 1946 total deliveries were 809,600 kW, exports representing 275,600 kW. The high proportion of exports this year is no doubt due to the completion of orders placed long before this country's "power crisis" and the share of overseas customers will probably show a fall in due course. Nevertheless the electrical industry is called upon to maintain its overseas connections as far as possible while providing the essential plant for home use, a dual burden which can be sustained only by the accordance of special preferences.

Electric Water Heating

GOVERNMENT Departments are actively discouraging the use of electric water heaters. The Chancellor of the Exchequer has imposed a 66⅔ per cent purchase tax on them and the Ministry of Health is frowning upon their use in new housing schemes. We have a feeling, however, that discouragement can go too far. Hot water is considered a necessity in the modern home and the electrical way is frequently the most economical method of obtaining it; it is generally the most efficient way. If water heaters can be prevented from augmenting the peaks, and it is by no means certain that they do, they have much in their favour. The growing tendency of "authority" to regard domestic electrical appliances as most undesirable in present circumstances needs to be watched.

Load Shedding Precautions

ALTHOUGH plans for reducing the industrial peak demand during the winter will relieve our overburdened generating plant, they may still be insufficient to prevent "load shedding," although it is hoped that last winter's disastrous experiences will be avoided. Consequently the Electricity Commissioners, in consultation with the electricity supply industry, have decided that maximum demand "targets" must be set for each undertaking the exceeding of which will result in cuts to consumers. So far as possible sufficient warning will be given to those establishments likely to be affected. Details of the proposals are set out in this issue (page 299).

Diesel Electrification

IN this issue (p. 292) we describe the new Diesel-electric locomotives to be constructed by the Southern Railway for putting into passenger service late next year. They are 1,600-h.p. units and it will be possible to couple two of them to provide tractive power for a 500-ton train, under the control of a single crew. The significance of the development lies in the fact that it is the first major step in the Southern's scheme for the displacement of steam locomotives over a large area by Diesel-electric or all-electric traction. Last week we reported the L.N.E.R. board's decision to construct a number of Diesel-electric units for hauling its Anglo-Scottish expresses.

City & Guilds Finances

CONCERN was expressed at the annual meeting of the City and Guilds of London Institute by Professor R. S. Hutton, chairman of the Council, at the deficit of £7,348 incurred during 1946. It had arisen because of the increased activities of the Department of Technology and to help meet it the Department had had to raise its fees. Professor Hutton and others who followed him deprecated the Institution's having to restrict in any way the pioneering by which it had attained its present position of regard—a view which will be shared by many readers who have benefited from the work of the Institute. Indeed at a time when technical education is assuming greater and greater importance there must be expansion rather than contraction.

High-Speed Reclosure

Use of Auto-reclosing Circuit Breakers on High-voltage Systems

By J. R. Mortlock,
B.Sc.(Eng.), M.I.E.E., Mem.A.I.E.E.

ON high-voltage systems the relative percentage frequency of occurrence of different types of fault are on the average:—Three-phase, 5; two-phase to earth, 10; phase to phase, 15; phase to earth, 70. The majority of faults are transitory, and consequently only in exceptional cases is it necessary to keep a line out of service for an appreciable time.

Arc-suppression coils could be used to counteract the effects of phase-to-earth faults, but at very high voltages their application may not be economical, as apart from the necessity of all transformer windings being fully insulated, the conductor corona loss would have to be limited, and this may call for the use of an excessively large conductor. An alternative is to use auto-reclosing circuit breakers which only de-energize the circuit long enough for the fault to clear itself. The latter method is particularly useful on existing systems to which arc-suppression coils could not be applied due to graded insulation on transformers or to too high a corona loss when one line is earthed or to a non-transposed unsymmetrical configuration of conductors.

When stability is important a circuit should remain disconnected for the absolute minimum of time. This would be the sum of the times needed for the operation of the protective gear, the breaker interruption and the fault-path deionization.

Modern high-speed protection should operate in times of the order of one cycle (0·02 sec). Representative total break times for the interruption of a fault current by, for instance, a 132-kV circuit breaker are as follow:—Air-blast, 4·5 cycles (0·09 sec); normal oil breaker, 7 cycles (0·14 sec); oil breaker with resistance switching, 3 cycles (0·06 sec).

The time required for the fault path to recover sufficient dielectric strength to withstand the reapplication of voltage is to some extent fortuitous, but tests carried out on a circuit as shown in Fig. 1 give sufficient data for an estimate to be made of the percentage of reclosures following on transitory faults which would result in the circuit being restored. In applying the data obtained from these tests, full cognizance should be taken of the fact that they were carried out on a circuit from which the actual lines were omitted; the conditions, therefore, differ from those experienced in service with relatively long lines and distributed circuit constants. The test sequence was as follows: (1) Circuit breaker A open, B closed, C open; (2) A is closed initiating arc; (3) B opens; (4) after pre-set time interval, C closes and voltage is reapplied across the gap G which was short-circuited by a fuse wire.*

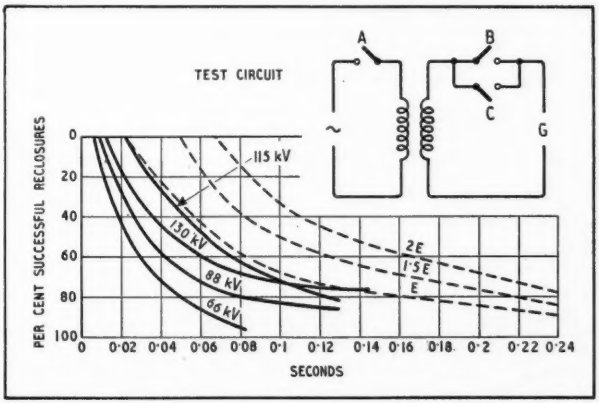


Fig. 1.—Gap-dielectric recovery characteristics

E = 132-kV system; - - - = suggested performance. Note: Test points are averages of a number of tests: actual values are not given. In the diagram of the test circuit A, B and C are circuit breakers and G is an arc gap short-circuited by a fuse wire

* Keeping the Line in Service by Rapid Reclosure: S. B. Griscom and J. J. Torok: *Electric Journal*, May 1933, p. 201.

Consider the case of a transmission line with breakers at both ends on a system with a solidly earthed neutral. Assume that an earth fault occurs near one end of the line and that the breaker near the fault clears first.

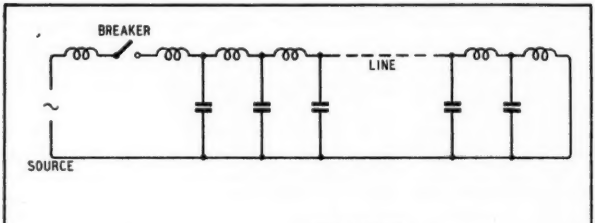


Fig. 2.—Voltage distribution on line with fault at the remote end

When the current through the breaker at the far end passes through a zero value, the voltage along the line will be as shown in Fig. 2 for various power factors. With normal breakers the circuit can be considered as purely reactive and the circuit power factor as zero, whereas with breakers incorporating resistance switching the power factor will be improved and at a current zero the voltage along the line will be reduced.

This reduction in the voltage along the line is of material benefit, as, subsequent to the interruption of the circuit by the breaker, the line will discharge at its natural frequency through the fault path and consequently the current in this path will be effectively zero only at some time subsequent to its isolation from the system. Moreover, the time to reach zero will be governed by the magnitude of the charge on the line, which is proportional to the square of the voltage. The natural-frequency currents obtaining with and without resistance switching for a fault at the end of a model line, using a recurrent technique, are shown in Fig. 3. With a fault at one end of the line, limiting conditions are being considered, and in practice faults may occur anywhere. Consequently, in the average case the natural-frequency current duration will not be as long as shown. Nevertheless, it is reasonable to assume that in general the natural-frequency current with normal breakers will last for about 0·01 sec longer than with breakers incorporating resistance switching.

The time required for the deionization of a fault path is governed by the voltage appearing across it when the breaker recloses. In general the circuit will be re-made through the breaker when the voltage across its contacts is a maximum and the initial conditions correspond to the sudden application of the system-frequency voltage at its peak value. This results in a voltage wave travelling to the remote end of the line and, if this is open-circuited, in full reflection with a doubling in magnitude at this location. The conditions with resistance-switching circuit breakers

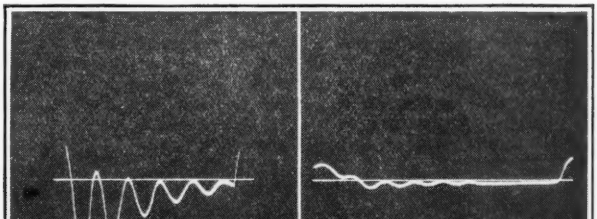


Fig. 3.—Natural-frequency discharge currents in the fault path subsequent to the isolation of the fault from the system. (a) Breakers without resistance ; (b) breaker with 2,400 ohms resistance

are radically different; the voltage is applied to the line through a resistor and consequently there is a very material reduction in the magnitude of the voltage wave. Typical comparative results of the voltage at the far end of a model line, using a recurrent technique, when breakers with and without linear resistance switching are used, are shown in Fig. 4.

With resistance-switching breakers, a further transient voltage occurs when the resistance is short-circuited. The effect is identical with the application of a cancellation voltage across the resistor, and the higher the voltage across the resistor the greater the magnitude of the transient voltage applied to the circuit. The resulting travelling wave can be reflected to twice its value at the open end of the line and this voltage, more so than that obtained on the initial closure through the resistor, may govern the required time for deionization.

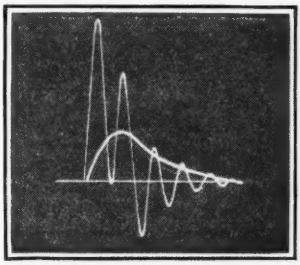


Fig. 4.—Voltages at the open-circuit end of a line when energized at a voltage peak at the other end. Oscillatory trace-breaker without resistance; exponential trace-breaker with 2,400 ohms linear resistance

The voltage obtained under this condition on a 70-mile model line with 2,400-ohm linear resistors in the breaker was 1·2 times the normal phase value, E, compared with 1·85 times when no resistance was used. Thus in this case also the advantage of resistance switching is maintained, but if the resistor had a much higher ohmic value the voltage condition would approximate to that for a normal breaker.

Using the data from Fig. 1 and a basis of 80 per cent restorations, the overall time during which a line would have to be disconnected from a 132-kV system is as follows for various types of circuit breaker.

(*a*) *For an air-blast breaker.*—Protective gear (0·01 sec) + breaker clearance (0·09 sec) + natural-frequency current extinction (0·015 sec) + deionization time (0·24 sec based on 1·85E) = 0·35 sec.

(*b*) *For a normal oil circuit breaker.*—Protective gear (0·01 sec) + breaker clearance (0·14 sec) + natural-frequency current extinction (0·015 sec) + deionization time (0·24 sec based on 1·85E) = 0·405 sec.

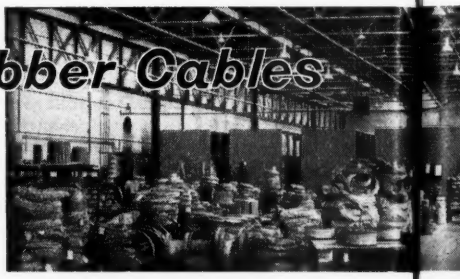
(*c*) *For an oil circuit breaker incorporating resistance switching.*—Protective gear (0·01 sec) + breaker clearance (0·06) + natural-frequency current extinction (0·005 sec) + deionization time (0·11 sec based on 0·7E, when the circuit is re-made through the resistance, plus contact overlap time) or + deionization time (0·19 sec based on 1·2E when the resistance is short-circuited), whichever is the greater = 0·265 sec.

The actual performance would be better than 80 per cent restorations, as with a fault along the line the transient voltage appearing across the fault path on reclosure would not be as great as that for a fault at the end of the line, and probably a time setting chosen on the basis of 60 per cent restorations would be satisfactory. The corresponding total times would be:—Air-blast breaker, 0·22 sec; normal oil circuit breaker, 0·27 sec; oil circuit breaker with resistance switching, 0·17 sec.

It can be concluded that linear resistance switching as applied to oil circuit breakers, instead of requiring an increase in the total time from fault occurrence to restoration of the circuit, as would appear necessary without detailed consideration, can be used with times at least as short as those which would be employed with normal breakers. Furthermore, the minimum overall time for a reasonable number of successful restorations is 0·2 to 0·25 sec.

Story of the Grid

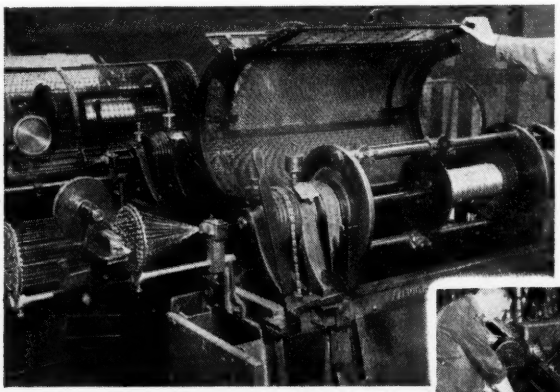
AT the present time of transition there is a need for a comprehensive but succinct history of the origin and operations of the Central Electricity Board. Such a work would not only be of use in educational institutions of many kinds but also to the many laymen who will become members of the Boards and Councils which will be set up under the new Electricity Act. The need is well met by a brochure which the Board has just produced. In twenty-six pages, with ten illustrations and a map, it has been possible to tell the story of the grid in a readable style without superfluous "trimmings." A table gives salient statistics for the eight areas (including North Scotland) and a complete list of selected stations is appended. Copies of the brochure may be obtained by those interested upon application to the Board's Public Relations Officer (Mr. W. J. Hendry), Trafalgar Buildings, 1, Charing Cross, London, S.W.1.



Making Rubber Cables

Essential Processes Described

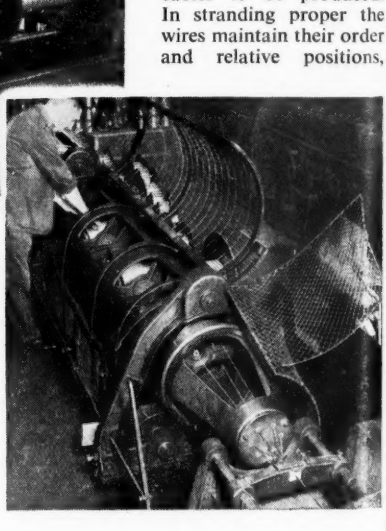
THE many demands on its Press by the vigorous electrical industry, with its unprecedented ramifications into all other industries and, as we have so recently and forcibly seen, its importance in all sections of national life, are difficult to meet in the face of to-day's restrictions. Nevertheless, we still find it incumbent on us to pursue as actively and as frequently as conditions permit our policy of presenting to our readers concise but accurate accounts of how standard equipment and materials with which they are familiar in the finished state are produced. This article in particular relates to the production of rubber-insulated and rubber-sheathed cables, and we are indebted to British Insulated Callender's Cables, Ltd., for their ready co-operation in our task during a recent visit to the company's factory at Helsby, Cheshire.

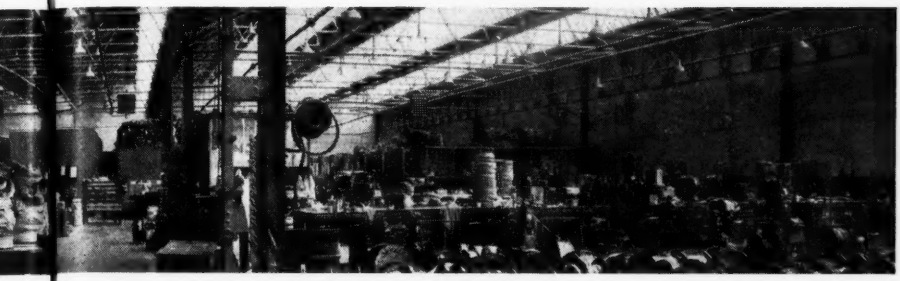


"Bunching" is a form of stranding in which there is some predetermined order applied to the wires. Stranding involves the feeding (right) on to a central travelling wire of other wires revolving about it

The processes involved in the preparation of conductors and in lead sheathing are common to all, or most, forms of standard cable, so that more opportunities occur for describing these particular processes. We therefore propose to give our attention more fully to the methods employed for rubber insulating and rubber sheathing, without ignoring those processes which, although they are common to other types of cable, are also essential to all, or some, rubber cables.

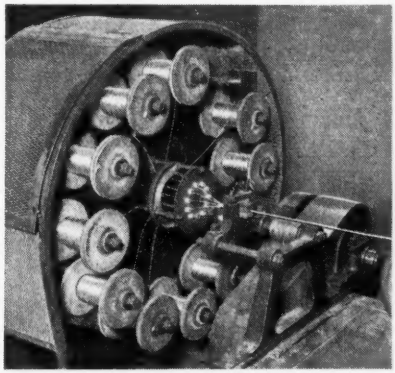
Tinned copper wire for the production of the conductors is prepared at and received from the company's works at Prescot in sizes generally ranging from 0·0076 in. to 0·103 in. for the manufacture of a range of standard wires, cables and flexibles in sizes from 14/0·0076 to 162/0·0076 in the case of flexibles, and from 1/0·044 to 127/0·103 in the case of solid or stranded conductors. The wires as received are ready for immediate use on the stranding machines which vary according to the types and sizes of the cables to be produced. In stranding proper the wires maintain their order and relative positions,





or changes of position throughout the whole lengths of the strands, with one central wire around which are laid other wires in totals of 7, 19, 37, 61, 91 or 127 wires.

Broadly, however, the term stranding includes "bunching" which is employed exclusively for the production of flexible conductors in which there is applied some predetermined order for the individual wires throughout the lengths of strands. In principle, the stranding machines are all similar, with modifications; while a central wire travels through the machine other wires are fed on to it from bobbins on a carriage which revolves about the central wire. In the same way, for making the larger cables or cores the strands so built up can be further multi-stranded, each strand in this case being treated as a single wire.



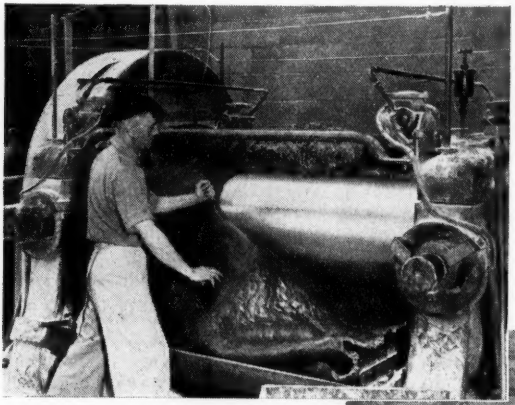
In multi-stranding each strand is treated as a separate wire

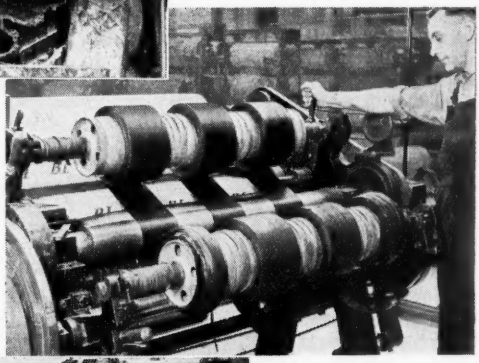
Having produced the strands it is now necessary to insulate them, but an early part of the insulating process is concerned with the preparation of the rubber which is received in bales of crepe or smoked sheet. The bales are first cut up into pieces about 2 ft long and 4 in. by 3 in. in section to facilitate easy handling. Cutting is done on hydraulically operated guillotines. In preparation for their delivery to the mixing plant the slabs are first passed through straining machines in which all foreign matter is removed by the passage of the rubber through fine-mesh sieves. After leaving the strainer the rubber is sheeted into a convenient form for handling, and then, together with the filling agents, it is sent forward to the mixing plant. The filling powders, such as carbon black, french chalk, zinc oxide, etc., are also pre-treated by sieving before they are passed on with the rubber to the mixing plant. The prepared rubber and fillers are then loaded into containers in the correct proportions ready for delivery to the mixing plant.

Each of the most modern mixing plants consists of a Banbury mixing equipment mounted on a stillage and incorporating a horizontal cylindrical container in which two rolls revolve in opposite directions and thus effect a shearing operation on the materials between them. This mixing operation is carried out to a definite time cycle to obtain the required homogeneous mixing of the material. While the application of heat is necessary at first for warming-up purposes, afterwards the problem is to reduce the frictional heat created by the process, and the temperatures are controlled by an elaborate water-cooling system. The material is then discharged into the mill at floor level immediately under the mixer, and sheeted out into convenient sizes for further processing.

From the mill the sheet is passed on to warming-up rolls on which it is prepared as rubber compound of a suitable consistency

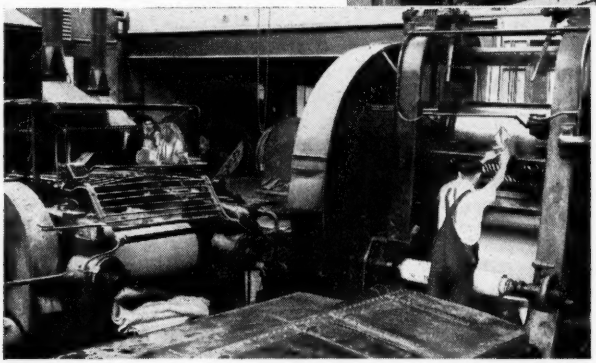
for treatment in the calender in which the material is then reduced to various thicknesses ranging from, say, 10 "thous" up to 40 "thous." Calendering consists of rolling the rubber out into sheets under strict and related conditions of pressure and temperature control, coupled with the spacing of the steam-heated bowls (rolls) with the result that the thickness of the sheet is carefully regulated throughout. After calendering the sheet is run into calico liners to prevent the layers sticking together, and in the roll form in which it is removed from the calender it is stored for a setting-off or recovery period.





After passing through the strainer the rubber is sheeted out on a mixing mill in a convenient form for handling

The calendered sheet is next cut up into various widths suitable for its application to cables by passing it under roller knives and re-rolling the strips so produced. At the same time the calico is separated and re-rolled. Rubber is applied to the strands in two ways—on longitudinal machines for the smaller sizes of cables, and on lapping machines for the larger sizes. On a longitudinal machine the wires or strands in any required number up to, say, thirty are fed through grooved rolls between and with two of the rubber strips, one strip above and one below the strand.

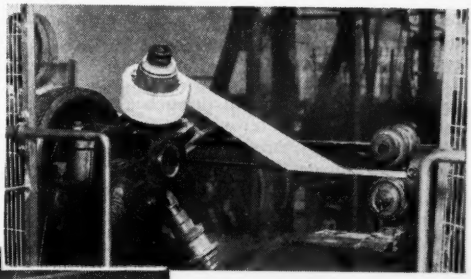


Above: Calendered rubber is separated from the calico and slit into widths suitable for application to the strands as insulation
Left: The sheet from the mixing mill is treated in warming-up mills on the left which prepare it for calendering (right)

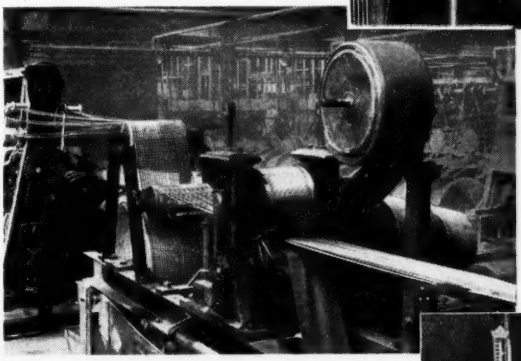
Each wire or strand, with the rubber strips, is engaged by a pair of grooves, one groove on the top roll and one on the bottom roll, so that the rubber is pressed round the strand to meet at the roll surfaces between the grooves where the rubber is cut and the edges of the halves round the strand are sealed by the pressure

of the rolls. Several layers of rubber can be applied by one machine in a continuous sequence of operations during one passage of the strand through the machine.

Lapping involves winding the rubber strips round the central travelling strand as the strips are fed from reels which revolve round the strand. Here again several coverings can be applied to the strand through the machine, and this sequence usually includes a final application of tape to "hold" the rubber during the later vulcanizing process.

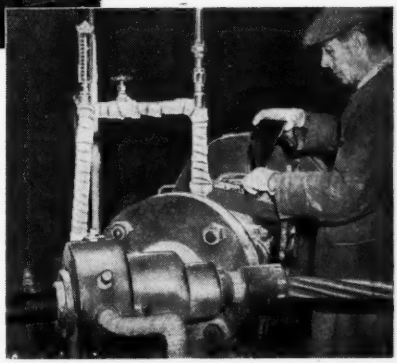


Insulating by the lapping process involves winding the rubber strips around the central travelling strand



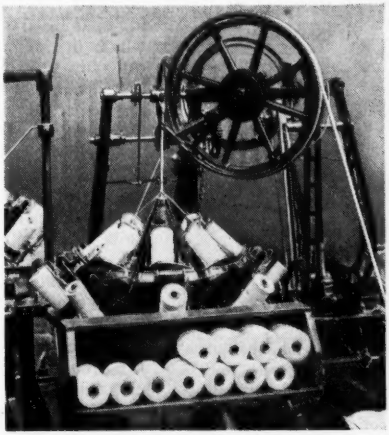
Longitudinal insulating is accomplished by feeding the wires or strands with two rubber strips through grooved rolls

Vulcanization is a method of heat treatment which renders the rubber less plastic, and is carried out in steam-heated pans. The insulated conductors are first wound on to special cylinders which are grouped as cruets on cradles suitable for crane handling for loading the wound cylinders into and unloading them from the pans. Vulcanization takes place at about 290 deg F and over a period of, say, 20 to 30 minutes, according to the size of the cable, i.e., the mass of the rubber to be treated. The pans are each equipped with a steam-heated jacket, but steam is also



In the extruding machine the rubber is forced through a die to form a tube around the central travelling core or cores

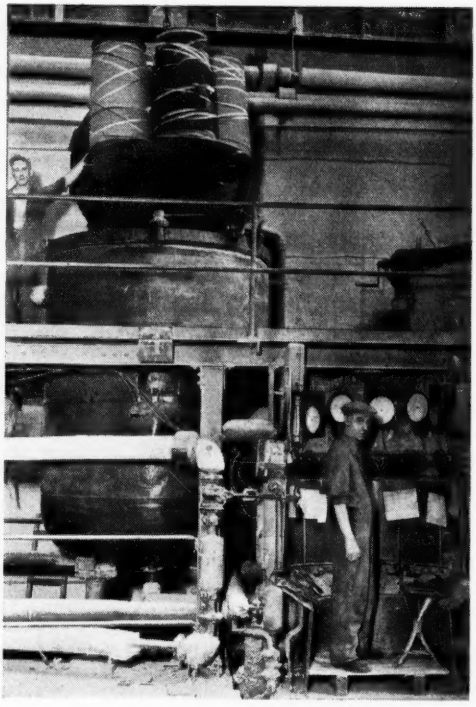
strand in one sequence of operations on the same machine during one passage of the



Braiding necessitates the rotation of a number of bobbins around a travelling core on to which the bobbins unwind their cotton, etc.

fed directly into the container, and it is the direct contact with the steam which actually results in vulcanization.

After vulcanization the cables are unwound from the cylinders, passed through a spark testing machine and rewound in one combined operation. During its passage through the spark testing machine the rubber insulation is in continuous contact with chain electrodes charged at varying voltages. At the same time the conductor is earthed, so that a defect in the insulation will result in a passage of current from the chains to the conductor. Sensitive indicating and alarm equipment is incorporated in the testing machine. All cables in the core stage after vulcanization are passed on to the inspection and testing department where the cores may again be electrically tested by applying electrical pressure while the cables are submerged in water tanks. The immersion tests, consisting of pressure and insulation trials, and test voltages, which vary according to the types of cable under treatment, are available in excess of 100,000 volts. The testing installation also incorporates instruments for such control tests as a.c. and d.c. capacity, power factor, and conductor resistance. After testing, the cores are passed back to the factory for further processing.



The cruets of unvulcanized cable cylinders are crane handled for loading and unloading the vulcanized pans

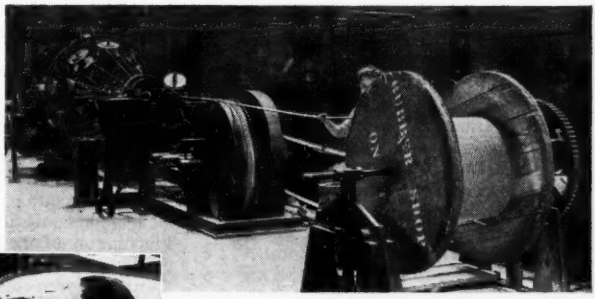
The cable is at this stage in the core state in which it is ready for (*a*) braiding for the production of flexibles, or braiding and compounding for the production of house-wiring cables; (*b*) sheathing for the production of rubber- or lead-sheathed cables; or (*c*) laying-up for multi-core cables, in which case the cable may subsequently be subjected to processes (*a*) or (*b*). Braiding is effected on a variety of machines operating on a common principle involving the rotation of a number of bobbins around a central travelling core, at the same time unwinding their cotton, silk, jute or even wire on to the core. The intricate relative movements of the bobbins result in a "maypole" or similar pattern in the braided material. Protective wax compound is applied to certain braided cables by running them through a tank of molten compound. Cable for aircraft or automobiles is polished in a room where it is passed through cellulose lacquering tanks and then run out through a long tortuous path for drying.

Rubber sheathing is applied by extruding the rubber received from the mixing and milling plant, after it has first been treated on adjacent warming-up mills from which it is cut off into strips for feeding into the extruding machines.

The core goes through a central die in the extruding machine, and at the same time the rubber is forced through the die on to the core, thus forming a tube round it. Obviously the rubber thus applied as a sheath must also be vulcanized, and for this purpose the cable from the extruding machine is wound internally in trays in which french chalk is liberally applied to it. In the large sizes of cable which usually include multi-core

laid-up cables, taping of the unvulcanized sheath is first necessary for "holding" the rubber until it has been vulcanized, and in these cases de-taping becomes a subsequent process.

In laying-up the required number of cores are assembled in their correct order. This is carried out on a variety of types and sizes of machines according to the products required, but in principle their operation is the same as that of the stranding machine, the cores being unwound from the reels on a revolving carriage and converging to a central point where the assembly actually takes place. At the same time twine, jute, cotton or rubber cords are fed from other bobbins on the carriage to fill in the interstices between the cores.



Laying-up provides for the assembly in their correct order of the required number of cores

Smaller extruded cable is wound in vulcanizing trays, french chalk being liberally applied

Lead-sheathing involves the feeding of semi-molten lead from a suitable heating container through a die through which the core is travelling so as to form a tube of lead around the core. Certain types of cables are lead sheathed before the rubber sheathing is vulcanized. The lead is stripped off afterwards and this imparts a very smooth finish to the rubber sheath, a most desirable feature in some cables required to be used under special conditions.

Operations subsequent to lead covering include armouring and braiding, armouring being carried out by similar methods to those used in stranding. The last major operation before packing, etc., before dispatch, is the final testing to which reference has already been made.

Our appreciation and thanks are due to the factory management for their assistance.

French Power Prospects

IN spite of restrictions electricity consumption in France reached a record of 84 million kWh upon one day this year. Electricité de France will be able to supply a maximum of 90 million kWh a day in 1947-48, which means that restrictions will be comparable to those enforced in the past year. There are hopes, however, that this will be the last difficult winter for France. Next year a new section of the programme for the equipment of barrages and thermal plants will have been completed, and the Genissiat barrages particularly will help considerably in improving output.

During the course of the year the following hydraulic equipment will come into service (with annual production in million kWh):—

Alpes: La Girotte (Savoy), 40; Castillon (Lower Alps), 78; Veneon (Isere), 36; La Brillanne (Lower Alps), 79.

Massif Central: Cajarc (Lot), 10; Lardit (Aveyron), 50; Versilhac (Haute Loire), 35; Diege (Correze), 5.

Pyrénées: Aston-sur-Aston (Ariege), 126; Olette (East Pyrénées), 52; Plan-d'Arem (Upper Gar.), 14; Mouaux (Hautes Pyrénées), 96.

In addition, the following thermal equipment will be commissioned:—

Mining plants: La Buissiere (Nord), 400; Henin-Lietard (Nord), 250.

Others: Gennevilliers, one group (480-500) at the beginning of 1948 and another in the middle of the year.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Safe Installations

I HEARTILY agree with Mr. D. B. Salter regarding a "certificate of competence." Whenever we carry out an installation we always display near the fuse board a special card bearing the words "Entire Installation by," "Overhauled by" or "Additional Lighting by," and so on followed by our name and address with 'phone number. We find that this is good advertising and it also gives our clients confidence in our work. Furthermore it helps the electrical inspectors.

Highbury, N.5. ROY GORDON,
Managing Director
(Roy-Mac Electrical Co., Ltd.)

FROM Mr. D. B. Salter's point of view, we in the contracting industry, have not enough red tape and humbug; we should saddle ourselves with further restrictions and humble ourselves to being puppets of the supply authority.

There are two organizations in this country which deal with inspection and testing of installation contractors. Let them do the job and be recognized by the supply authorities as a competent body of men. Where supply authorities do installation work they also should be registered with one or other of the organizations, and their work should be checked to see that it complies with current regulations. This definitely would make for safer installations.

Spalding. L. ADLINGTON, A.M.I.E.E.
(G. Clifton & Co., Ltd.).

Armature Drop Winding

IN reply to Mr. W. Goirer in your issue of August 15th, armature drop testing is carried out by applying e.m.f. from a small bank of batteries to the commutator of the armature under test. The e.m.f. will vary according to the size of the armature conductors, but I find in practice that 4½ V is ample for testing fractional-h.p. jobs.

The battery leads should be bound to the commutator with thin cord and spaced about a quarter of the way round the commutator. By placing the two leads from a milli-voltmeter on to adjacent commutator segments the reading will indicate the millivolt drop in that particular coil. This should be repeated round the commutator until all the segments have been tested, the battery leads being, of course, moved round each time after testing a particular section.

Points to remember are:—Needle deflecting part way denotes partial short circuit; needle deflecting full scale denotes open circuit; needle stationary denotes dead short or, if on reversing the leads from the millivoltmeter a reading is obtained it denotes cross connection. This, as will be appreciated, applies only to a newly wound armature. Fluctuation of the needle over a number of segments adjacent to each other indicates a short between coils.

New Malden. H. C. JACKSON.

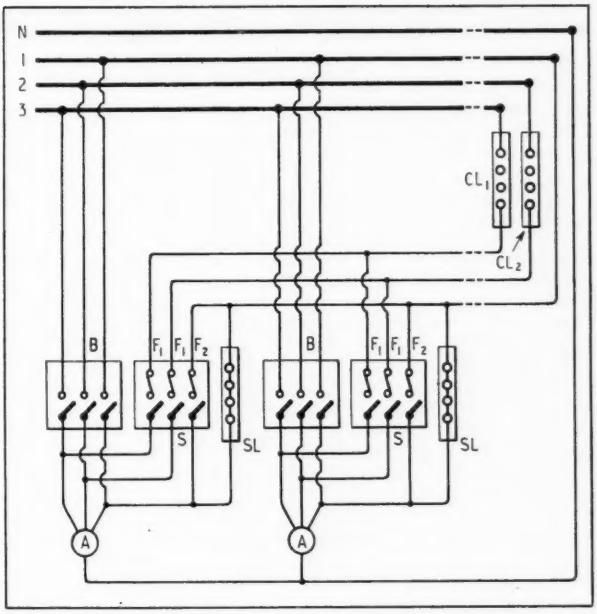
Paralleling Diesel Sets

DURING the fuel crisis six 35-kVA 400-V three-phase four-wire Diesel-driven alternators were installed and successfully run in parallel with the use of the following apparatus. Each set was equipped with its own switchboard, comprising triple-pole circuit breaker, voltmeter, phase ammeters and hand field control. A system of signal lamps and fuse-switches was connected as shown in the accompanying circuit diagram for two of the machines. One blade of each switch makes contact through fuse F2 with one line of the bus-bars. The other two switch blades make circuits comprising four pygmy lamps connected in series. Across the switch blades connected through F2 is a similar arrangement of lamps.

The procedure is as follows:—One alternator is adjusted to the correct speed, excited to the required voltage, and the circuit breaker B1 is closed, connecting it to the dead bus-bars. The second alternator is then started up and its excitation raised to bring the volts equal to the bus-bar volts. If the speed of the two machines is different, the synchronizing lamps will alternately light up and go black at a frequency related to the difference in speed of the two sets. The speed is adjusted until these lamps remain black, whereupon the synchronizing switch is closed. This locks the incoming alternator on one phase through fuse F2 to the first alternator which is on the bars.

The check lamps CL1 and CL2 should also be black. If this is not so, it indicates wrong phase rotation or the failure of fuse F2 due to faulty speed adjustment. If the check lamps are black, the circuit breaker B2 can be closed. The synchronizing switch must then be opened immediately and the excitation of the two machines adjusted in order to give equal excitation.

The locking fuse F2 prevents damage to the plant in the event of careless synchronizing. The synchronizing switch can be installed within reach of the throttle of each engine to enable synchronizing to be carried out by one man. The check lamps CL1 and CL2 are not essential, but are useful. "Black lamp" synchronizing was found to be easier to judge than the "bright lamp" method.



Circuit diagram for paralleling Diesel-driven alternators

A—Alternators. B—Circuit breakers. S—Iron-clad triple-pole synchronizing fuse-switches. SL—Synchronizing lamps. CL—Check lamps. F1—2-A fuse. F2—15-A fuse

Since unequal excitations give rise to circulating wattless currents, which can be misleading if ammeters are the only guides to the machines' output, the writer connected pilot wires to the exciter terminals of each machine and brought them to a six-way switch (made from a converted d.c. starter faceplate) to which was connected a d.c. voltmeter.

In this way the excitation volts of each machine could be read from a central point and, since all the sets were identical in type and size, these voltages were adjusted to be equal under each load condition. This arrangement, together with judicious adjustment of individual throttles, enables load to be balanced simply. The same device can be used for dissimilar machines, provided the relationship between the excitation volts and the load at the rated voltage is known for each machine.

If the sets are fitted with automatic voltage control, the makers must be consulted before parallel running is attempted, since some types are unsuitable for such operation. If in doubt, it is safer to disconnect the controllers and run with hand operation until advice can be obtained.

D. M. BARBER,
B.Sc. (Eng.), A.M.I.E.E.
Leatherhead. (British Vacuum Cleaner & Eng. Co., Ltd.)

Motors in the "Media"

THE new Cunarder *Media*, which is due to sail on her maiden voyage shortly, is equipped with approximately 2,000 h.p. of electric motors, including those on the cargo winches, supplied by Laurence, Scott & Electromotors, Ltd. There are twenty 5-ton "Scott" winches for cargo handling and a 3-ton gangway winch. The larger motors include two of 13/85 h.p. for the main circulating pumps, a 27/36 h.p. for the ballast pump, two of 12/24 h.p. for bilge and general service pumps, three 14/20 h.p. for forced lubrication pumps, two 67 h.p. and two 50 h.p. for the forced and induced draught fans respectively. All the motors and starters are of the company's standard marine type, with minor modifications to meet Cunard requirements.

Views on the News

Reflections on Current Topics

A DOCTOR points out in the *Daily Telegraph* that electricity tariffs are so designed as to decrease the price per kWh as usage increases. He thinks that with the present shortage the reverse should be the case, i.e., the greater the consumption the higher the "unit" cost. This negation of the usual trading principles and of all that the electrical industry has done in the past is an interesting possibility. It would most certainly prove effective as a deterrent if electricity for cooking, say, went up to 1s. per kWh. Proposals have already been made that a penalizing charge should be made for energy consumed in excess of a stated amount but have been abandoned on the ground that it would create a law for the rich against the poor. I suspect the doctor to be a lighting-only consumer.

* * *

I recently read a report that in two and a half months of its existence the U.S.S.R. Society for the Dissemination of Political and Scientific Knowledge had organized about 1,500 lectures. One lecture was devoted to the British Empire. Whilst scientists here endeavour to extricate themselves from political considerations and keep aloof, particularly from international politics, the contrary seems to be the case in a society whose title proclaims a joint activity. Science is not divisible according to race or creed.

* * *

One matter of the greatest importance to the staffs of electricity supply undertakings is the question of superannuation under the new régime. I was therefore interested to read the comments on the National Coal Board's arrangements by the Committee of Public Accounts in its third report published last week. In an earlier report the Committee had expressed the opinion that the Board's superannuation benefits went much beyond those allowed to civil servants and should not be regarded as a desirable precedent. The Treasury agreed with the opinion but said that there were practical difficulties in achieving uniformity in superannuation schemes of public boards. When the State took over an industry such as the coal industry, a great variety of existing schemes were found some of which provided very generous terms; but where the undertakings had relied on high salaries and savings by their employees, there might be no scheme. The Treasury considered that general schemes of nationalized industries should be settled on broad lines conforming with accepted standards.

* * *

Reports of shocks on buses recur from time to time and I hear that complaints have recently been made of slight electric shocks received on Glasgow buses. Mr. E. R. L. Fitzpayne, the general manager of the Glasgow Corporation Transport Department has written to the local Press to the effect that such complaints are being investigated, and points out that the condition is aggravated by the long spell of dry weather. One "non-static" tyre, which I assume means a conducting rubber tyre, is being fitted to each bus as the supply of such tyres becomes available.

* * *

During the war the Germans constructed power lines for the purpose of "draining off" electricity from Belgium for use in Germany. Since the liberation the flow has been the other way and Belgium has been receiving power from the Rhine and Ruhr areas as an appropriate form of reparations. Last week the Belgian Fuel Ministry denied reports that this supply was to be suspended. I should think that there is still a balance due to Belgium after the five-year occupation.

* * *

I have no doubt that someone will tell me that the idea is not a new one, but till I looked through an American journal recently I had not come across an electrical conduit with a knurled inside surface. This, it is claimed, makes wire pulling as much as 30 per cent easier, a factor that should have a noticeable effect on costs in large installations.

* * *

The Americans always have a word for it. In an editorial note on the use of gas-pressure relays for transformer protection the *Electrical World* points out that one objection to their use is the fact that they are super-critical. It goes on to suggest that interest in the device would be revived in America if there were produced a gas-pressure relay not prone to be "trigger-happy."—**REFLECTOR.**

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE second Swann Diploma examination under the auspices of the Association of Supervising Electrical Engineers was held on May 28th and 29th at Derby, Edinburgh, Manchester and London.

The following candidates were successful and receive diplomas:—Electrical installation and maintenance work: Messrs. W. Brooks (Bolton), T. E. Christian (East Dulwich), W. J. Gardner (Southall), (with credits in administration and organization of work), E. J. Moore (Sidcup), (with credits in administration and planning of installations), A. Spencer (Blackburn), W. G. Street (Falkirk) (with credit in organization of work), and J. R. C. Waterston (Blackhall, Edinburgh) (with credits in technical ability and organization of work). The following passed in Part I of the examination and may enter again for Part 2 within two years, in accordance with the regulations:—Electrical installation and maintenance work: Messrs. S. P. Baussmann (Stanford-le-Hope), H. J. Doughty (Stafford) and W. J. Phillips (Gravesend).

An announcement will be made shortly in respect of the next examination to be held in May, 1948.

Mr. J. J. Chaplin, protective gear assistant with the Norwich City Electricity Department, has been appointed technical assistant (mains) with the Oxford City Electricity Department. Mr. Chaplin takes up his new duties on September 1st.

Mr. W. A. Barnett, M.I.E.E., M.I.Mech.E., of Wellington, Salop, who has been generating engineer to the West Midland Joint Electricity Authority for a number of years, in charge of the generating stations at Ironbridge, Shrewsbury, Wolverhampton, Walsall and Ocker Hill, Tipton, is retiring on superannuation on August 31st. He has received a cheque from his colleagues, and is being presented with a testimonial engrossed on vellum by the Authority later. Mr. Barnett has been in the Wellington district for sixteen years, and his experience has covered forty-two years in marine and electrical engineering in different parts of the country.

Mr. L. H. Mansell, B.Sc., M.I.R.E., has joined the technical sales staff of the Electrical Equipment Co. (Leicester), Ltd. He was apprenticed to the McKenzie, Holland and Westinghouse Power Signal Co., Ltd., subsequently having several years experience in the radio trade. Mr. Mansell served in the technical branch of the Royal Air Force during the war.

Mr. D. Watt, B.Sc., M.I.E.E., has been appointed sales manager (home) of Lancashire Dynamo & Crypto Ltd. Mr. Watt, who has been London sales manager for the last four years, will continue to operate from the company's London office, 94, Petty France, Westminster, S.W.1.

Following the announcement of the appointment of the British Transport Commission, the salaries to be paid to the members were made public. **Sir Cyril Hurcomb,** the chairman, is to receive £8,500 per annum and the other full-time commissioners £5,000 each.

Mr. R. F. Gyngell

We recently reported that **Mr. R. F. Gyngell,** who has been assistant secretary of W. T. Henley's Telegraph Works Co., Ltd., for many years, has succeeded Mr. A. H. M. Jacob, now an executive director, as secretary of the company. We now reproduce Mr. Gyngell's portrait.

Mr. W. P. Hooper, Wallasey Corporation Electricity Department, has retired after forty-two years in the industry. He acted as hon. treasurer of Liverpool section of the E.P.E.A. for fourteen years, and is a member of No. 3 D.J.I.C. and D.J.B. for the Electricity Supply Industry.

Mr. J. H. Warwick, sales director of Tube Products, Ltd. (a member of the Tube Investments Group) is to spend two to three months in Brazil. He leaves early next month. During his visit Mr. Warwick will make a survey of future prospects on behalf of the steel tube division of Tube Investments, Ltd. He will also deal with matters affecting associate companies, including the electrical division of Tube Investments, Ltd.

Mr. H. V. Crosse, lately with Veritys, Ltd., has been appointed southern area manager, Ekco-Ensign Electric, Ltd., from August 1st. He will be located at the London office, 5, Vigo Street, W.C.1.

Mr. F. G. W. Tree, A.M.I.E.E., of Glasgow, has been appointed lighting engineer for Scotland for Thorn Electrical Industries Ltd. Mr. Tree has held executive positions in electric power supply and has been responsible for many important lighting installations.

Mr. S. P. Roper of Leyland Avenue, Wolverhampton, has been appointed to the Colonial Postal Service as Assistant Controller of Telecommunications (Engineering) in Malaya. Mr. Roper studied at the Central Technical College, Birmingham, and Coventry Technical College.

He is an associate of the Central Technical College and a graduate of the Institution of Electrical Engineers. He has held appointments with the General Electric Co., Ltd., Coventry, Joseph Sankey & Sons, Ltd., Wolverhampton and at the Central Technical College, Birmingham as lecturer in electrical engineering.

An announcement by the Sheffield Corporation Electricity Department reproduced in our issue of August 1st, gave the name of Mr. F. J. Williams as one of those appointed junior assistant engineers. We are informed that this should have been **Mr. F. J. Wilkins.**

Mrs. Kerr, the wife of Mr. A. N. D. Kerr, A.M.I.E.E., has given birth to a son. Before her marriage Mrs. Kerr (then Miss E. S. D. Robinson) was with Crompton Parkinson, Ltd., for ten years.

Mr. N. Hull (Bell & Hull, Ltd.), **Mr. L. Scot** (Eirco (Wholesale), Ltd.), and **Mr. G. R. O. Morris** (Edwards & Edwards, Ltd.), the three members in Northern Ireland of the Electrical Wholesalers' Federation, recently entertained members of the North Western Section of the Federation, to which they are attached, pending the full operation of a section in Belfast. The meeting lasted three days, one of which was devoted to business, and the other two to pleasure in the form of golfing and motor tours.

The official opening of the new sports ground provided by the Electrical Apparatus Co., Ltd., St. Albans, for its employees took place on August 9th, when the first sports meeting since 1938 was organized. The new ground has an area of eleven acres with two hard tennis courts; provision for grass courts is contemplated. The occasion was taken to present long service recognitions to thirty-eight employees, who had been with the firm for periods ranging from 25 to 37 years and it also marked the end of a nine-weeks' production drive. The long service recognitions together with production and sports prizes were presented by **Mr. R. H. Barbour,** chairman of the company. An attractive programme of amusements was provided for the children, and later there was dancing.

Ekco Social and Sports Club, with a total of 569½ points after four matches, comfortably won the cup presented at the end of this year's series of athletic contests against the Essex firms, Marconi (529), Hoffmann (410) and Crompton Parkinson (283½). A match was played on each company's ground, the final being at Crompton Parkinson's on August 11th. The trophy was handed over by Mr. Gardiner, of Crompton Parkinson, to Mr. D. Willman, Ekco sports chairman.

Philips (Blackburn) Works, Ltd., held its sports and gala in Witton Park, Blackburn, on August 16th, under ideal conditions. There was an attendance of about 10,000 people and there was keen competition in the various events. **Mr. C. de Wit,** managing director, welcomed the townspeople and expressed his appreciation of the excellent programme of sports, etc. Two bands and a concert party gave selections and other features were a children's fancy dress parade, a baby show and the election of a "radio queen."

Obituary

Mr. J. Carter.—The death occurred suddenly on August 11th of Mr. Jabez Carter, director of J. Carter & Sons (Bradford), Ltd., electrical contractors. Mr. Carter was a former chairman of the Bradford branch of the Electrical Contractors' Association.

Mr. F. H. Webb.—We regret to record the death of Mr. F. H. Webb, which occurred on August 12th, in his 53rd year. Mr. Webb was manager of the Newcastle branch of Siemens Electric Lamps & Supplies, Ltd. He joined the company in London in 1908 and in March, 1936, was appointed Newcastle branch manager.

Will.—Mr. Leslie Gordon, formerly clerk and solicitor to the London and Home Counties Joint Electricity Authority, who died on March 8th last, left £6,909 (net personalty £5,047).

British Association

Programme for Dundee Meeting

THE British Association for the Advancement of Science is holding its annual meeting in Dundee from August 27th to September 3rd. Sir Henry Dale will deliver his presidential address on August 27th his subject being "Science in War and Peace." In Section A (Mathematics and Physics) on August 28th there will be a discussion on "Peacetime Applications of Nuclear Fission," the contributors to which will include Prof. J. D. Cockroft, Dr. O. R. Frisch and Mr. W. G. Marley. On the following day Sir Edward Appleton will deliver his presidential address to the Section on "Earth, Stars and Radio," and this will be followed by a discussion on radio applications in astronomy and meteorology, those taking part being Dr. E. G. Dymond, Mr. H. L. Wright, Dr. R. L. Smith-Rose, Mr. J. S. Hey, Dr. A. B. Lovell, Mr. M. Ryle and Mr. H. G. Booker. The discussion on September 3rd will deal with infra-red radiations and their applications. On September 1st in Section B (Chemistry) the discussion will be on chemical resources and industries of Scotland, to which Mr. A. G. E. Robiette will contribute "Hydro-electric Power Utilization."

Section G (Engineering) will open with an address by the president, Sir William Halcrow, on "Progress in Modern Engineering," and the programme includes "Scottish Water Power Development, with special reference to Electrical Problems," by Mr. J. Henderson on September 1st, and "Applied X-Rays: the Non-destructive Examination of Butt-welds," by Mr. W. D. Garrick on September 2nd. The Tummel-Garry scheme will be inspected on August 30th.

Coal-Mine Lighting

Higher Standards and Better Maintenance

A MEMORANDUM has been issued by the Ministry of Fuel and Power (M. & Q. Form No. 136, Stationery Office, price 3d.) in explanation of the Coal Mines (Lighting) General Regulations, 1947, the object of which is to improve the standard of illumination underground. These new regulations indicate the positions where more light is needed and different ways of providing it, subject to exemptions at the discretion of divisional inspectors.

The whitening of roofs and sides is required to be "effectively" applied and maintained, but no particular method is specified. Complementary thereto is the requirement to furnish, at the same places, "sufficient and suitable" general lighting wherever persons are working and also when a shift of persons is passing. A definite standard is not laid down. Every person employed below ground at any place at which general lighting is provided must have with him a portable electric lamp for emergency use.

The new regulations permit the employment of mains lighting nearer to the coalface than has previously been authorized. Indeed, subject to certain conditions mentioned in the memorandum, it could be used almost without restriction in all mines and, moreover, 250 V is now permitted instead of 125V, which should help towards the introduction of fluorescent lamps. Certain of the 1934 provisions are repeated, relative to system earthing, approval of types of apparatus, robustness of fittings and care in the placing of sources and distribution of light to avoid glare and deep shadows.

Lamp Performance

New standards of performance have been set for safety lamp bulbs, in two parts as defined in the first appendix to the memorandum. The higher standard refers to bulbs filled with krypton gas and the lower to argon bulbs, which will be withdrawn when the former type becomes available in sufficient quantities. Bulbs must be of approved types and marked as prescribed in the second appendix. From the beginning of 1949 the new standard of light will apply to all safety lamps used underground, not merely to those employed at certain places as previously.

Also, from the same date, every person ordinarily engaged in haulage work must use an electric cap lamp, so that he has both hands free; furthermore it must comply with the higher lighting standard. Thus two-stage replacement of safety lamps which do not comply with the new standards will be necessary: by December 31st, 1947, for all lamps in use at the face and by December 31st, 1948, for others. The third appendix prescribes how the performance of safety lamps shall be determined while the fourth appendix classifies safety lamps.

The new regulations, for the first time, demand a prescribed minimum standard of maintenance for safety lamps. The maintenance test itself is laid down as well as the method by which samples of lamps shall be selected for making the test of compliance. A recommendation is added that a regular system of photometric testing should be introduced at collieries, not necessarily by the lamp-room staffs, but to ensure that the effectiveness of the maintenance service may be regularly assessed at the colliery.

Australian Notes

ALLUDING to the very drastic restrictions owing to the desperate fuel shortage as a "sorry state of affairs" the Melbourne city electrical engineer and manager (Mr. B. Woodfull), in his report for the year ended September 30th last, sees little hope of any return to normal conditions in the current year. Deliveries of black coal ceased altogether during the year and the steam plant became dependent on coke breeze and brown coal briquettes. For the first time there was a deficit on the year's working. To alleviate the conditions the use of off-peak storage heaters is being investigated.

Brisbane Services.—Fuel supplies are also a matter of "considerable concern" in Brisbane, according to the City Council's annual "Statistics." Price is mentioned, but measured by our own position the increase from 16s. 7d. to 21s. 9d. a ton (pit-head) since 1929 is not large. An additional factor of complaint is the rise in the average ash content from 11·2 to 21·2 per cent since 1934. In 1945-46 the output of the New Farm station was 172·2 million kWh at an average operating cost of 0·367d., compared with 174·6 million kWh at 0·359d. in the preceding year. Following collaboration with the State Electricity Commission the Council has started investigations in connection with a new station to deal with the future growth of load in Brisbane and South-eastern Queensland.

The power house is operated as a subdepartment of the tramways undertaking which last year made a net profit of £204,147 despite a reduction in traffic through strikes. To relieve surface traffic and speed up transport it is planned to take the tram track underground in busy sections.

In 1945-46 the electricity undertaking established its second highest profit (£86,594). Sales were about the same as in the previous year at 110·8 million kWh. Consumers at the end of the year numbered 70,587 (against 68,850), giving an average consumption of 1,569 kWh per consumer.

Locomotive Testing

New L.M.S. Mobile Electrical Plant

IT has been the custom for many years to test locomotives by means of a dynamometer car interposed between engine and train, which records on a moving chart speed, tractive effort and units of work done under ordinary running conditions, the speed varying according to the natural variations of gradients and other forms of resistance. The results so obtained represent an average of all the changing conditions experienced throughout the run.

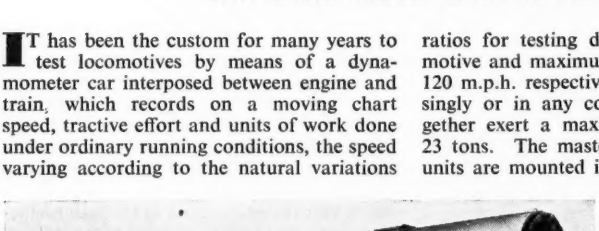


Fig. 1.—One of the three electric braking test cars

More accurate locomotive testing would necessitate long stretches of practically level and straight track, which do not exist in Britain, but immediate adjustment to compensate for track effects can be made by the use of electric locomotives with rheostatic braking under very sensitive control which will maintain an exactly constant speed irrespective of changes in drawbar pull and resistance of the track.

A new test train, known as the "mobile testing plant," was authorized by the London, Midland and Scottish Railway in 1936, comprising a special tender, a dynamometer car and three braking units. Each of the braking units (fig. 1) is, in effect, an electric locomotive designed for braking instead of pulling and is capable of absorbing up to 1,500 h.p.; they are very similar in design except that they have different gear ratios for testing different classes of locomotive and maximum speeds of 50, 90, and 120 m.p.h. respectively. They may be used singly or in any combination and will together exert a maximum braking effort of 23 tons. The master controls for all three units are mounted in the dynamometer car, which thus serves both as an independent vehicle for controlling the braking units and to measure the speed and drawbar pull of the locomotive.

The braking units, which were practically completed in 1939, were used during the war as emergency power generators and are now being reconditioned. The tender and the dynamometer car are as yet uncompleted, but tests are already being carried out using the low speed unit and the company's No. 1 dynamometer car, which is being equipped with the master controls and other necessary apparatus.

The special tender, which can be attached to any locomotive of standard type, is intended for measuring the rates of consumption of coal and water during the test. A

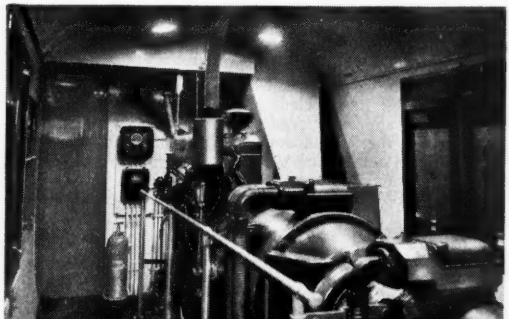


Fig. 2.—Auxiliary Diesel generating set

corridor connects the front of the tender with the dynamometer car so that access may be gained to the locomotive footplate during the run.

The new dynamometer car will be a double bogie coach with a single additional unflanged road wheel on the leading bogie for accurately measuring the speed of the train and the distance travelled. It will contain an Amsler hydraulic dynamometer coupled to the leading draw-hook through friction draw-gear and connected with a recording table which will furnish continuous records of drawbar pull, speed, work done, etc., on a basis of either time or distance. The master controls of the three braking units are to be fitted on a desk panel and instruments will indicate the loading of each of the units. Another panel will carry temperature indicators, etc., for studying the working of the locomotive while running.

Fig. 4.—Control compartment of braking car

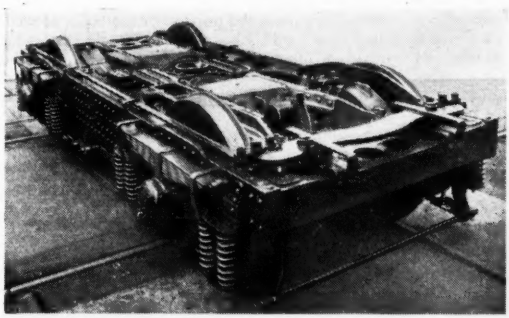


Fig. 3.—Higher-speed bogie showing mounting of braking generators

The braking units are similar in construction to very powerful motor coaches, the "motors" actually being generators resisting the motion of the train. The power generated is absorbed by banks of resistance grids, which are cooled by being situated in vertical "chimneys" up which a current of air is forced by motor-driven fans. The energy of braking is thus finally dissipated in two columns of hot air expelled vertically through openings in the roof.

As the full power of the generators may be required at very low speeds, they are separately blown by motor-driven centrifugal fans. The large amount of auxiliary power required for the resistance fans, the blowing and excitation of the generators, and other purposes, necessitates the provision of a 100-h.p. A.E.C. Diesel engine and generators (fig. 2) connected in parallel with a 120-Ah battery, which will provide stand-by power in an emergency and heat and light when the generating set is not running. Separate auxiliary generators driven by the same engine will provide the excitation for the main generators and a.c.; the auxiliary engine room is in the middle of each braking unit.

The bogies of the braking units are of the four-wheel pattern, each having two generators rated at 375 h.p. each. In the bogies of the low-speed unit the generators have suspension bearings and are supported by the axles as in a normal motor coach. But it is undesirable for this arrangement to be used for the higher speed units, as the large unsprung weight on the axle would tend to damage the track. They are therefore supported directly from the bogie frames by brackets (fig. 3) and the generator shaft is geared and connected to the axle by means of Andrews–English Electric flexible axle drives, made by the railway under licence, specially developed for high powered

motor coaches to permit the axle to move vertically as required by the suspension. At the same time, they are self-aligning and permit a certain amount of lateral movement to allow for clearances in the boxes or distortion of the bogie frame.

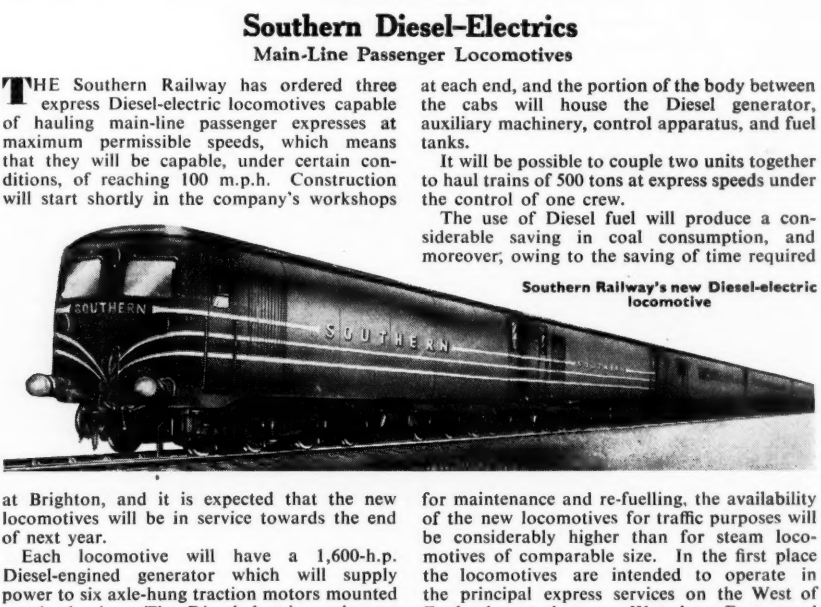
Considerable attention has been given to the design of the automatic control which regulates the loading of the main generators so as to ensure constant speed. In the dynamometer car a small tachometer generator is driven from the unflanged wheel and generates a voltage proportional to the speed of the train, which is balanced against a fixed voltage representing the speed to be maintained, so that the difference represents the error between the actual and the required speeds. The voltage difference is amplified and transmitted down the train to the braking units, in each of which is a thyratron rectifier set controlling the main generator excitation. Stabilizing devices prevent "hunting" and each unit has also a master control so that it may be operated independently of the train if desired. The principal controls of each braking unit are centralized in a compartment (fig. 4) at one end of the vehicle.

The basic principles of these units were evolved by Dr. H. I. Andrews of the company's Research Department and the subsequent development and construction were shared between the L.M.S. company's chief mechanical engineer, who built the units in the Derby shops, and the B.T.H. Co. which supplied the main electrical and control equipment. Other principal suppliers include the A.E.C. Co., J. Stone & Co., Chloride Electrical Storage Co., British Timken, Ltd., David Brown, Ransome & Marles, Jonas Woodhead and the Telephone Manufacturing Co. The principal instruments were obtained from Amslers, Negretti & Zambra, Ltd., the Cambridge Instrument Co. Ltd., and George Kent, Ltd.

Southern Diesel-Electrics

Main-Line Passenger Locomotives

THE Southern Railway has ordered three express Diesel-electric locomotives capable of hauling main-line passenger expresses at maximum permissible speeds, which means that they will be capable, under certain conditions, of reaching 100 m.p.h. Construction will start shortly in the company's workshops at Brighton, and it is expected that the new locomotives will be in service towards the end of next year.



Southern Railway's new Diesel-electric locomotive

Each locomotive will have a 1,600-h.p. Diesel-engined generator which will supply power to six axle-hung traction motors mounted on the bogies. The Diesel-electric equipment is being produced by the English Electric Co., Ltd.

The body and underframe will be mounted on two eight-wheeled bogies, three of the axles in each bogie being driven. Each unit will weigh about 120 tons in working order, and will be 62 ft long. There will be a driver's cab at each end, and the portion of the body between the cabs will house the Diesel generator, auxiliary machinery, control apparatus, and fuel tanks.

It will be possible to couple two units together to haul trains of 500 tons at express speeds under the control of one crew.

The use of Diesel fuel will produce a considerable saving in coal consumption, and moreover, owing to the saving of time required for maintenance and re-fuelling, the availability of the new locomotives for traffic purposes will be considerably higher than for steam locomotives of comparable size. In the first place the locomotives are intended to operate in the principal express services on the West of England route between Waterloo, Exeter and Plymouth, but they will also be capable of working on any other main line route of the Southern Railway.

The present order is the first major step in the company's scheme for the displacement of steam locomotives over a wide area by Diesel-electric or all-electric traction.

COMMERCE and INDUSTRY

Generation in July. Australian Transformer Order.

ELECTRICITY generated by authorized undertakings in July totalled 2,866 million kWh compared with 2,765 million kWh in July, 1946, an increase of 101 million kWh (3·7 per cent). The kWh sent out totalled 2,698 million (against 2,597 million).

During the first seven months of the year 24,522 million kWh was generated compared with 23,246 million kWh in the corresponding period of 1946, an increase of 1,276 million kWh (5·5 per cent). The figures for kWh sent out were 23,140 million and 21,925 million respectively.

Transformers for Australia

The English Electric Co., Ltd., has been awarded by the State Electricity Commission of Victoria a contract for the supply of transformers for the first 220-kV system to be operated in Australia. The contract comprises seven 18,000-kVA type OFB single-phase transformers for installation at the Commission's power station at Yallourn, and four 16,666-kVA type ON single-phase transformers for the Kiewa No. 4 power station. The company already has in course of manufacture transformers of 64,000 kVA, ratio 225/112·5/10·5 kV 3-phase, for Finland, and 40,000 kVA single-phase forming a 3-phase group of ratio 242-121/15·75 kV for Russia; also three arc suppression coils of 24,000 kVA rating for operation on a 220-kV system in Finland. These coils are believed to be the largest and highest voltage units yet ordered from this country.

"Electrical Review" Index

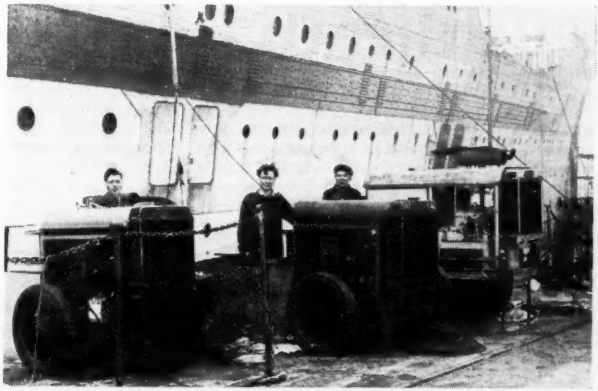
Readers who have not yet obtained a copy of the index to Volume CXL (January-June, 1947) and wish to do so should apply to the Publisher, *Electrical Review*, Dorset House, Stamford Street, S.E.1.

Ministry Bans Water Heaters

At a recent meeting of the Aldridge (Staffs) U.D.C., the vice-chairman of the Housing Committee said that the Ministry of Health had again declined to sanction the installation of electric water heaters in 244 of the Council's houses although these appliances were to be seen in the shops and there seemed to be no difficulty in getting and installing them. The chairman of the Committee said that he appreciated the Ministry's attitude; it had in mind the amount of electricity which the heaters would consume and their effect upon the winter fuel supply. To this the vice-chairman replied that the tenants had to use fuel of some sort to heat their water.

Refitting the "Queen Mary"

The Cunarder *Queen Mary*, which recently resumed her normal transatlantic runs after war service, had to be considerably refitted, and a large amount of new steelwork was required. This was prefabricated by John Brown & Co., Ltd., at Clydebank and fitted in position on board ship at Southampton. For the necessary welding the London Welding Co., Ltd., used nineteen "Murex" portable welding sets. Many of these sets, some of which are shown in the accompanying picture, were located on the sides of the dock and fitted with long welding leads, the total length of cable used for this purpose being over four miles. "Vodex" type electrodes were used by the welding sub-contractors.



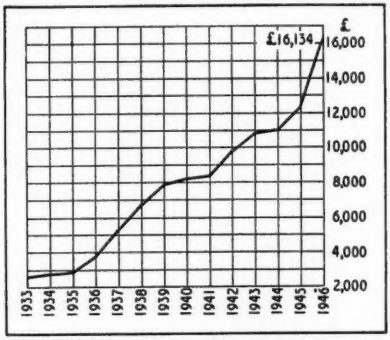
Some of the "Murex" welding sets used for refitting the "Queen Mary"

The major part of the large decorative lighting fittings were removed when the ship was put into war service and these have had to be overhauled and replacements made where necessary. The G.E.C., who were originally responsible for the design and manufacture of a large part of the lighting installation, replaced

glassware and relacquered the metalwork, and many of the large decorative fittings, stored in various parts of the world, were practically rebuilt.

Mounting E.I.B.A. Grants

During the last fourteen years the payments to beneficiaries of the Electrical Industries Benevolent Association have risen at an ever-accelerating rate as is clearly seen from the graph reproduced herewith. This provides a



How E.I.B.A. grants have risen during the past fourteen years

clear indication that the rise has been due only in part to the higher cost of living and it is also a reminder of the need for all electrical people to increase their help.

But money grants are only one means by which the Association helps to settle beneficiaries' problems. Its personal assistance has increased to an even greater extent and this has had the effect of actually reducing the monetary aid necessary in a number of cases. For this great credit is due to the voluntary work of enthusiastic workers in the cause.

Diamond Dies

A companion to BS 1168—1944 relating to diamond dies for wire drawing has been issued (BS. 1393) as a first attempt to specify reinforced dies of this kind with bores up to 0·06 in. diameter. Its preparation has been difficult but, even if not fully adequate in certain respects, it will serve to guide both manufacturers and users. Desirable characteristics of the stone are indicated while minimum wall thicknesses and weights for various bores are laid down.

Provision is made for three grades of finish of the hole: its dimensional accuracy is prescribed and notes are included on methods of examining and measuring the bores. The essential dimensions of the die case are specified, together with a marking system indicating the material for which the die is suitable. Appended are detailed large-scale diagrams of typical profiles of die bores for drawing copper, bronze, resistance, steel, and tungsten wires with a monograph by Dr. D. P. Dudding on the relation between the dimensional characteristics of commercially graded stones and the requirements which are laid down in the specification.

Copies can be obtained from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 2s. 6d.

L.N.E.R. Manchester District Control

The L.N.E.R. Manchester District control office, evacuated to Godley during the war, has returned to the London Road Station. Entirely new equipment has been installed in the control room, which is now one of the most modern in the country. All the equipment was supplied and installed by Standard Telephones and Cables, Limited.

More than one hundred signal boxes and other key operating points in Lancashire, Cheshire, the West Riding and North Wales are connected to the new control. Thirty-one special telephone circuits are in use, sixteen of which are external and fifteen for inter-communication.

North-Western Polytechnic

Classes in electricity supply accounts and practice, conducted by Mr. C. F. Weedon, will commence at the North-Western Polytechnic, Kentish Town, N.W.5, on September 23rd. Enrolments are from September 15th to 19th and a prospectus can be obtained from the Head of the Department of Commerce.

Marine Radio

Three specifications of the minimum performance required of, and methods of testing, radio equipment installed in merchant ships have been prepared by the G.P.O. and issued by H.M. Stationery Office. The first (price 1s.) is concerned with general purpose, loudspeaker watch and emergency receivers; medium, long and short wave and emergency telegraph senders; and direction finding equipment. The second (price 3d.) deals with wireless installations in motor lifeboats carried on British ships. The third (price 2d.) deals with climatic and durability testing of both radio and radar gear, and should be read in conjunction with the Wireless Telegraphy Board's specification K.114. Compliance with these three sets of requirements is necessary for securing certificates of approval of the equipment from the Postmaster-General and, in the case of lifeboats, the Ministry of Transport.

Photography in Industry

The Exhibition of Applied Photography which was organized in London by Kodak, Ltd. recently is to tour the provinces. It opens in Leeds at the People's Hall, Albion Street (September 8th-12th); then goes to 244, Deansgate, Manchester (September 29th-October 3rd), McLellan Galleries, Sauchiehall Street, Glasgow (October

13th-17th), Chamber of Commerce, Birmingham (October 27th-31st) and winds up at the City Museum, Queen's Road, Bristol (November 10th-14th). The exhibition provides a practical demonstration of the usefulness of photography in document copying, stress analysis, X-ray inspection of castings and welds, data recording, motion study, air survey, visual aids to teaching, etc. Admittance is by invitation, and business executives, production managers and designers should apply to Industrial Sales Department, Kodak Ltd., Wealdstone, Harrow, Middlesex. There will be one day at each centre open to the public.

Price Control Orders Revoked

The Board of Trade, in consultation with the Central Price Regulation Committee, has made an Order revoking, as from August 12th, a number of maximum prices Orders which no longer serve any useful purpose. These include the Radio Valves (Maximum Prices) Order, 1942 (S.R. & O. 1942 No. 1934); the High Tension Dry Batteries (Maximum Prices) Order, 1942 (S.R. & O. 1942 No. 2512); the Imported Wireless Receiving Sets (Maximum Prices) Order, 1944 (S.R. & O. 1944 No. 200); and the Price Controlled Goods (Sales by Tender) (Maximum Prices) Order, 1942 (S.R. & O. 1943 No. 59).

Argentine Import Ban

Argentine import permits were suspended on August 13th until further notice on many more articles, according to a list issued by the Argentine Central Bank. The list is another in a series which began in June cutting permissible imports to what is termed "essential items." The latest list includes all types of batteries with the exception of those trade marked "Aircoll" or "Minimax," and copper wire and cables.

The Bank will consider the granting of permits for copper wire, cables and batteries to applicants who can prove that local industry is unable to supply their requirements.—*Reuter's Trade Service* (Buenos Aires).

Chilean Import Restrictions

Reuter reports from Santiago that about 79 items will be affected by Chilean import restrictions on non-essential goods announced by the authorities to take effect as from August 13th. The restrictions which will remain in force until December 31st next apply to radio receivers and certain electrical appliances.

Trade Publications

Plessey Co., Ltd., Ilford, Essex.—Four illustrated brochures (available to radio manufacturers only) describing in detail available ranges of electrolytic condensers, chokes, transformers, drives and couplings, turning motors, vibrators, potentiometers.

Manganese Bronze & Brass Co., Ltd., Handford Works, Ipswich, Suffolk.—Three illustrated brochures dealing with powder metallurgy, "Oilite" self-lubricating bearing metals and sintered metal filters.

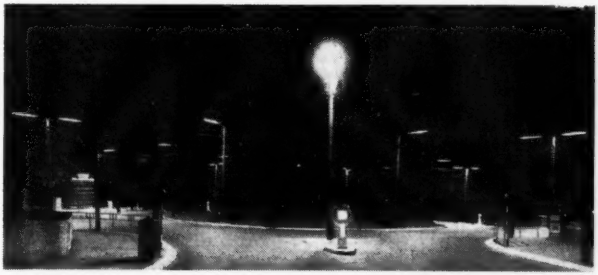
Carter & Co., Ltd., Nelson, Lancs.—Illustrated and priced list (No. 50) of all-electric "unit" heaters for factories and offices.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—Illustrated and priced catalogue (L.812), being the first post-war list of every type of "Mazda" lamp now available.

Readers are reminded, in applying for catalogues, that their applications should be made on their firm's notepaper.

Fluorescent Lighting at Bournemouth

Lansdowne "roundabout," Bournemouth, is now lighted by 80-W "Osram" 5-ft fluorescent lamps. The installation comprises twenty-five single-lamp cut-off reflector lanterns on brackets on trolley-bus poles and was erected by Mr. C. Coffin, public lighting superintendent, under the direction of Mr. W. C. Clowes, the borough engineer and surveyor. The lanterns are of G.E.C. design and the cut-off distribution, together with the low brightness of the light source, provides complete freedom from glare.



Fluorescent lighting of a Bournemouth "roundabout"

The colour approximates to daylight. Average intensity on the roadway is 3 ft-candles, although a reading of as much as 4-5 ft-candles was obtained at various points on the kerb.

Trade Announcements

Hogan & Wardrop, Ltd., have removed to 47-49, Caledonian Road, London, N.1 (telephone: Terminus 7191).

Aluminium Union, Ltd., has returned to the Adelphi, Strand, London, W.C.2 (telephone: Temple Bar 3535).

Building Materials Control

New "Priority" Arrangements

WE referred in our last issue (p. 255), to the introduction of the Control of Building Materials (No. 1) Order, 1947 (S.R. & O. 1947 No. 1698) which relates to the distribution of materials and components to users holding "W.B.A." priority. This makes it an offence, as from September 1st, to seek to acquire or to offer to supply in respect of a priority certificate quantities in excess of those authorized by that certificate; and as from October 1st next it will be an offence for those concerned to supply against a non-priority order whilst a current priority order remains unfulfilled.

The scheme has been simplified by the reduction of the number of forms to be filled in to two. Under the new Order there will be only one form of application and one form of declaration. The W.B.A. materials priority scheme was originally designed to cater for the building industry, but now that it has statutory sanction it is necessary to ensure that exports and other industries of national importance which use scheduled materials are not placed at a disadvantage in obtaining essential requirements, and provision is made under the Order to meet these requirements.

Electrical Equipment Covered

The materials scheduled in the Order include the following electrical components:—Metal conduit and conduit boxes of types normally used for domestic purposes; plugs and socket outlets with or without switches, three-pin up to and including 15 A; main switches, switch-fuses, and fuse-boards up to and including 60 A of types normally used for domestic purposes; switches, tumbler, wall type (surface, semi-recessed or flush) and ceiling types, up to and including 15 A of types normally used for domestic purposes.

As from September 1st priority certificates will have the force of law and purchasers of the scheduled goods who have claimed priority for orders which have not already been delivered should, before that date, cancel their claim to priority on any outstanding orders not covered by a certificate to avoid the possibility of infringing the Order. Any new orders placed after September 1st must be accompanied by a declaration.

As from November 30th not only new orders but all priority orders placed before September 1st must be covered by declarations. Intermediate suppliers who supplied goods against priority orders placed with them before September 1st but have not obtained replacements from their suppliers on November 30th should give full details to the Regional Materials Distribution Officer who will issue a priority certificate for the outstanding balance of the materials or equipment.

Until the declaration form (B.M. 106) is available purchasers should send with their priority orders a form of declaration that they hold priority certificates authorizing them to quote a symbol for materials specified and merchants must declare that they hold customers' declarations claiming priority for the goods listed.

Trade Marks

APPLICATION has been made for the registration of the following trade marks. Objections may be entered within one month from August 6th:—

RAYDOWN. No. B646,977. Class 9. Electrical apparatus included in Class 9.—Mc. & B. Heat Control, Ltd., 89, High Street, Epping, Essex.

LEGG. No. B647,476. Class 9. Transformers, voltmeters and battery charging, testing and rectifying apparatus, all being electrical goods; and hydrometers.—Legg (Industries), Ltd., Williamson Street, Wolverhampton.

COLUMBINE. No. 648,706. Class 9. Electric vacuum cleaners. COQUETTE. No. 648,707. Class 14. Electric clocks.—C.V.A. Jigs, Moulds & Tools, Ltd., 329, Portland Road, Hove, 3, Sussex.

PLESSEY. No. 648,762. Class 9. Electrical apparatus and instruments included in Class 9.—Plessey Co., Ltd., 56, Vicarage Lane, Ilford, Essex.

GLENDOW. No. B646,553. Class 11. Lampshades and lampshade holders.—Owens & White Electric Accessories, Ltd., 71, Westow Street, London, S.E.19.

Glen Shira Scheme

THE North of Scotland Board's project at Glen Shira (Constructional Scheme No. 12) has been confirmed by the Secretary of State for Scotland and has been laid before Parliament. The scheme is estimated to cost £3,150,000 and will employ up to 2,000 men. The main 40,000-kW generating station will be situated on the Arrochar-Inverary road at Clachan near the head of Loch Fyne. Output of electricity in an average year is estimated at 80 million kWh. After local demands have been met, the balance will be transmitted to a transforming station to be erected at Inveruglas and from there to existing lines supplying Glasgow and the West of Scotland.

The Board's Amenity Committee recommended that the pipeline should be concealed and that the generating stations should have pitch roofs, to which the Board has agreed. It could not, however, accept in full the proposals of the Fisheries Committee, but the Secretary of State reached the conclusion that the proposals made were adequate. No objection has been lodged against the scheme.

ELECTRICITY SUPPLY

Inquiry at Accrington. Commissioning of New Hams Hall Plant

Accrington.—POWER STATION INQUIRY.—An application by the Corporation to the Electricity Commissioners for consent to erect a new generating station costing £5,000,000 at Huncoat will be considered at an inquiry on August 27th. The objectors are mainly farmers and residents. The Central Electricity Board has already approved the scheme on the grounds of urgent need. An order for compulsory purchase of land in the district is also being opposed by the owners.

Birmingham.—COMMISSIONING OF NEW PLANT.—In connection with the extension of Hams Hall "B" station it is expected that the first of three 50,000-kW turbo-alternators scheduled for the second half of the station will be in operation within the next few weeks. The second set should be commissioned later this year and the third in 1948.

Blackpool.—REBATE UNLIKELY.—It is reported that there is little likelihood of a rebate being given in respect of the January-March quarter when restrictions were imposed. A report by the borough treasurer showed that such a rebate would cause a deficiency in the accounts for the year. An attempt to have the report referred back was defeated by a narrow majority. Councillor E. Duerden said that if a rebate ought to be paid it should be paid, but their officials who knew the facts said that the meters were reading correctly.

WORKS COMMITTEE.—A works committee is being formed in connection with the Electricity Department.

Derby.—ELECTRICITY EXTENSIONS.—To meet industrial development a new substation was recently opened by the Mayor, Ald. C. R. Bates, at Allenton. Trunk mains (33 kV) will provide the main feed from the projected power station at Swarkestone. The scheme has cost £95,000.

Finchley.—UNDERTAKING'S FINANCES.—The reason for the £10,819 deficit on the past year's working (in September last it was expected that there would be a small surplus, after allowing for tariff revisions) was recently explained by the chairman of the Electricity Committee (Councillor P Lawrence). He said it was due to increased distribution costs under severe winter conditions, increased debt and establishment charges as well as salaries and wages, and loss of revenue due to the restrictions. A preliminary estimate showed that a substantial deficit must be expected for the current year.

Hull.—HEATING NURSES' HOSTEL.—The Corporation is to carry out adaptations providing for the installation of central heating by electricity at the nurses' hostel, Pearson Park, at an estimated cost of £1,405.

LOANS.—Application is being made for further sanction to borrow £60,000 for extensions to mains and services, £30,000 for substations, and £25,000 for the purchase of cookers.

Lancashire.—HOSPITAL INSTALLATION. — The County Council proposes to carry out improvements to the electrical system at the County Hospital, Whiston, at an estimated cost of £3,000.

Nuneaton.—DISTRIBUTION SCHEMES.—To meet the increasing industrial and domestic loads the Electricity Committee has approved the laying of 6·6-kV cables at an estimated cost of £23,040. In connection with housing development three additional substations are needed and application is being made for loans totalling £9,061. Formal notice is being served on the Leicestershire and Warwickshire Electric Power Co. to increase the authorized maximum demand to 15,000 kW.

Portland.—HIRE SCHEME.—The Urban District Council has accepted recommendations by its electrical engineer (Mr. F. Normington) for a continuation and extension of a simple hire scheme for appliances. Whereas previously the cost of installation was charged to the consumer, the new scheme covers free installation and maintenance at quarterly terms varying from 3s. 6d. to 15s. for cookers, from 2s. 6d. to 23s. 3d. for water heaters, 1s. 6d. to 3s. for kettles, 1s. 6d. to 2s. 6d. for radiators, and from 2s. 9d. to 4s. for wash-boilers. Among the 1,600 domestic consumers the undertaking has on hire some 800 cookers, 900 kettles, 400 water heaters and 300 wash-boilers, in addition to apparatus owned by the consumers.

St. Marylebone.—CHEAPER ELECTRICITY.—In view of the £72,507 net profit on the past year's working of the electricity undertaking reductions in charges were authorized at the last meeting of the Borough Council. From the September quarter it is proposed to reduce the lighting flat rate by 1d. to 4½d. per kWh (through slot meters, 5d.); the two-part tariff scale is to be cut by 10 per cent and the power rate reduced from ⅛d. to ¾d. per kWh. These concessions will, it is estimated, reduce revenue during the current year by £34,000, but there is still expected to be a surplus at the end of the year of about £62,000.

Salford.—DISCONTINUANCE OF DEPOSITS.—The existing system of deposits for gas and electricity supplies is to be discontinued immediately. Recommendations of the Light, Heat and Power Committee to this effect were approved by the City Council at its last meeting. A deposit may still be required in special cases, however, when the amount will be settled in consultation with the engineer Repayment of

deposits and interest to consumers who have paid their accounts promptly for the past two years is to be started as soon as possible. Deposits paid before 1900 are generally to be considered as unclaimed and credited to the revenue account, which will meet any claims that are established.

Southend-on-Sea.—BULK SUPPLY.—The Town Council has agreed to submit to the Electricity Commissioners a revised scheme for increasing the bulk supply which is estimated to cost £220,350. It was stated that the Commissioners were not prepared to approve a modified scheme proposed to be carried out by instalments.

Torquay.—SUBSTATION.—The Corporation is applying for sanction to borrow £7,244 for a substation in connection with electricity supplies to the Corporation's housing estate, and a private estate at Higher Cadewell.

Wallasey. — HIGH-VOLTAGE SCHEME. — The Electricity Committee has approved in principle a revised scheme for the provision of a new e.h.v. feeder system between the Poulton generating station and the Seaview Road and Grosvenor Road substations together with the necessary ancillary equipment, estimated to cost £226,500.

Workington.—SUPPLY TO TRADING ESTATE.—The Corporation is to proceed with a scheme for the provision of electricity to the Salterbeck Trading Estate estimated to cost £8,500.

TRANSPORT

Glasgow.—ESTIMATED DEFICIT.—The Corporation Transport Committee has approved estimates providing for a capital expenditure in the next twelve months of £644,000, including £49,000 for vehicles and £94,000 for plant and buildings. During the past year the Department received delivery of only one new bus and one new tramcar. There is an estimated deficit this year of £199,000, due to increased wages and improved working conditions, including the 44-hour week. Last year the Department showed a surplus of £24,000.

Supply in Eire

Record Output Last Year

THE annual report of the Electricity Supply Board of Eire shows that sales of electricity increased from 379·1 million kWh in 1945-46 to 453·7 million kWh for the year ended March 31st last. Revenue from sales was £527,031 higher at £3,588,550, and the surplus of £248,940, which was £103,653 above the previous year's figure, has reduced the accumulated deficiency to £122,393.

On account of the heavy rainfall the inflow to both the Shannon and Liffey was considerably above the average and permitted the expansion of output to 572 million kWh—the highest ever achieved. The Ardnacrusha station produced 315 million kWh and the Liffey station 48 million. A peak load 14 per cent higher than in the preceding year was successfully met by using all plant to full capacity. The output of 205 million kWh from the Dublin steam station (Pigeon House) was attained under considerable difficulties due to inferior coal.

An analysis of the sales shows that motive power accounted for 173·0 million kWh (15·3 per cent inclusive) and domestic consumers for 168·6 million kWh (19·3 per cent inclusive). The largest percentage increases in consumption were, however, in public lighting (35·3), general lighting (26·4) and general heating, cooking and water heating (26·4).

Expenditure on new capital works under construction at the end of the year was £1,253,895, while the capital invested in plant put into commission during the year was £485,489 as compared with £460,169 in the preceding year. Considerable delays and difficulties were experienced in obtaining building materials and equipment for the construction of the new generating stations at Portarlington, on the Lower Erne River and at Leixlip, and the abnormally bad weather during the winter was unfavourable for building operations. Contracts were placed for the third Portarlington 12,500-kW turbo-alternator and the erection of the boiler plant, ordered in 1944, is expected to commence this year.

Contracts were placed for two 22,500-kW turbo-alternators for the Cathaleen's Falls station and for one 10,000-kW set for the Cliff station, with transformers, switchgear, etc. The erection of the second main generating set at Pollaphuca station was completed and the installation of the final switchgear and control gear is expected to be completed this year. At Leixlip the main coffer dam for the dam and the power stations has been erected and pouring of the concrete in the dam has commenced. The work on the installation of two additional boiler units and a new ash disposal plant at Pigeon House was well advanced.

A site for the second peat fuel station was chosen at Allenwood, Co. Kildare, and a contract was placed for four peat-fired units of 150,000 lb per hour each. Inquiries were issued to plant manufacturers for two 20,000-kW turbo-alternators and two 20,000-kVA transformers. A new station to be erected at Cork will have one 30,000-kW turbo-alternator set with boiler plant designed to use either oil or coal. Extensions to transmission and distribution lines included 73 miles of l.v., 87 miles of 10-kV, 15 miles of 38-kV and 39 miles of rural lines. Work was started on the rural electrification scheme. Unit areas of about 25 sq miles are to be developed.

Winter Power Cuts

Arrangements for Minimizing Disturbances

THE Electricity Commissioners have warned electricity supply authorities that while it is hoped that arrangements made for spreading the electrical load during the winter will result in a substantial reduction in the maximum demand on the grid, occasions are still likely to arise when load shedding will be necessary and the Central Electricity Board has considered in conjunction with the Commissioners and the Electricity Supply Joint Committee, various schemes for avoiding the difficulties which occurred last winter.

As a result of these deliberations, a scheme has been evolved by which each undertaking will have a "target" maximum demand to which the load must be reduced when called upon to do so by the Central Board either directly or indirectly. Preliminary target figures will be communicated to each undertaking as early as possible by the area managers of the Central Board, and as from September 1st, the maximum demand of the undertaking should be notified each week to the area manager. These weekly figures will enable any necessary adjustment to be made in the preliminary target figures before the winter really commences; if difficulty arises in reaching agreement with an area manager the matter should be referred to the Commissioners.

Maintaining Industrial Supplies

When load has to be shed to reach the target figure, everything possible must be done to maintain supplies to those industrial undertakings who have made arrangements to spread their loads to the satisfaction of the Regional Boards for Industry or who have shown to the Boards that they are unable to do so. If load has to be reduced below the target level, efforts should still be made to maintain important industrial supplies.

Undertakings are asked to consider what steps it is possible to take to reduce load without interfering with the supplies to industrial consumers. In this connection, say the Commissioners, the rota scheme which is being adopted by a number of undertakings has much to commend it. By this scheme the distribution network is divided into (say) five sections which can be switched out in daily rotation. By this means load shedding is confined to a particular section of the network on one working day of the week, and consumers can reasonably rely on immunity from load shedding on other days.

In an accompanying circular the Commissioners show that the maximum demand estimates for next winter made early this year by the supply authorities are not on a suitable basis. There is evidence that a large proportion of the estimates were unduly influenced by the demands arising during the fuel crisis.

It is considered that the maximum demands actually recorded in November and December, 1946, form the most suitable basis for the "targets", due regard being paid to prospective development. Undertakings were therefore asked to give information regarding the respective percentage contributions to the peak loads recorded in November/December, 1946, of:—public lighting and traction; industrial consumers; and general consumers and also to give the additional industrial load which they expected to connect by next winter.

Plant Available

At the same time an estimate was made, on the most up-to-date information, of the plant capacity which would be available in each of the C.E.B. Areas throughout the period October, 1947, to March, 1948. These plant figures, amounting in January, 1948, to a total of 9,530,000 kW, represent the simultaneous demand which can be met at standard frequency provided that no unexpected plant emergency arises. On the diversity actually experienced in November/December, 1946, the corresponding aggregate of area maximum demands in January, 1948, would be 9,742,000 kW and the sum of the demands of individual undertakings would be 10,030,000 kW. There is no reason to suppose that inter-area diversity, which is largely governed by geographical conditions, would be affected by a target scheme. On the other hand the limitation of individual undertaking demands to a predetermined target level must necessarily reduce very materially the diversity between individual demands within an area. It was felt therefore that the targets should be based on the assumption that the individual demands would equal the simultaneous demand of each area, thus limiting the provision for diversity to that represented by inter-area diversity. Thus the individual targets will in total be approximately 9,742,000 kW for the month of January, 1948.

The Government has laid down a general target reduction for industry of 33⅓ per cent of the maximum industrial loads recorded last winter. It will undoubtedly be difficult for industry to achieve such an overall reduction, especially as there is an appreciable proportion of continuous process work on which no reduction is practicable. It would therefore be unwise in preparing a scheme of target loads to assume that this 33⅓ per cent reduction will be fully achieved.

Calculation of the undertaking target peak loads for the month of January, 1948, have been made on a number of alternative bases of which the most suitable appears to be one which assumes that public lighting and traction loads

will be met in full; the contribution of industrial consumers will be reduced by some 20 per cent from that anticipated for January, 1948; and the contribution of general consumers will be limited to 10 per cent above that recorded in November/December, 1946.

Industrialists have complained that they are being called upon for drastic economies, while other classes of consumer are not being asked for an equivalent degree of sacrifice. In comparing the proposed 20 per cent reduction in industrial load with the apparent increase of 10 per cent in the demand of other consumers, it must be borne in mind that in the absence of fuel shortage the demand of general consumers is substantially higher in January/February than in the preceding November/December, whereas industrial demand shows little change. In assessing the industrial component of the proposed targets full allowance has been made for anticipated new loads, which amount to an increase of over 10 per cent on the industrial contribution in November/December, 1946, whereas no specific allowance has been made for the necessary increase in the demand of general consumers consequent on such factors as the progress of rehousing. The total allocation of kilowatts for general consumers included in the targets on the foregoing basis represents a reduction of some 12 per cent on the demands for those consumers included in the undertakers' estimates for next winter, although such estimates are on the basis of normal rather than severe winter weather and the aggregate demands of general consumers include a large number of essential services which must be maintained, so that the effective reduction in the demands of ordinary consumers, such as domestic, must be materially greater.

Fixing "Targets"

Provisional targets for individual undertakings will be examined by representatives of the undertakers, the C.E.B. and the Regional Boards for Industry and will be adjusted as necessary within the target allocated to each C.E.B. Area.

As the generating plant available will be lower in the months other than January it will be necessary to adopt correspondingly lower targets for those months and the most convenient method of defining them is to express them as percentages of the target allocations for January, 1948.

It is considered that the following procedure should be adopted: (*a*) That provisional target demands for January, 1948, with the appropriate percentage deductions for other periods, including the month of September, 1947, should be issued immediately to all undertakings, taking direct supplies from the C.E.B.; (*b*) that provisional target demands for undertakings taking indirect supplies should be assessed by the Board's district managers; (*c*) that all undertakings should be asked to send in to the district managers, commencing with the first week in September, particulars of their weekly recorded maximum demands; (*d*) that any necessary adjustment to the provisional target demand for each undertaking should be made before the end of September. Subsequent adjustments to individual targets can be made during the remainder of the period: (*e*) that load shedding should continue to be carried out only to the instructions of C.E.B. Control; and (*f*) that the first load shedding instruction should be to "Reduce load to target," and whenever possible advance notification of this instruction should be given during the preceding evening.

City & Guilds Report

PROFESSOR R. S. Hutton, M.A., D.Sc., chairman of the Council, presented the report for 1946 of the City & Guilds of London Institute at the recent annual meeting and reviewed and amplified the principal points. The report says that there has been an encouraging response to the chairman's appeal for support addressed to the City livery companies in December last. Activities have increased but the income has not risen correspondingly and there was a deficit of £7,348 for the year; the gap between income and expenditure will be largely adjusted by the increased fees now charged by the Department of Technology but further increases are thought to be inevitable.

In the City & Guilds College a Chair of Fluid Mechanics and Hydraulic Engineering has been established and in connection with it the English Electric Co. has made a donation of £2,000 per annum for five years to establish bursaries; six bursars have been appointed for 1946-47. Out of 104 students entering for the final (internal) B.Sc. (Eng.) degree examination 89 passed, 13 with first-class and 37 with second-class honours. Two passed the examination as external students.

A total of 36,299 candidates (4,028 more than in 1945) were examined in 123 subjects under the auspices of the Department of Technology. In the telecommunications group the number of examinees was 14,941 (60 fewer than in 1945). There were increases in the number of candidates in electrical engineering practice (1,182, increase 85); electrical installation work (454, increase 83); and radio service work (289, increase 33).

Reference is made in the report to the travelling scholarships awarded by the Worshipful Company of Tin Plate Workers, *alias* Wire Workers which have already been mentioned in the *Electrical Review*.

Among the new examinations which have been introduced are radio servicing, radio amateurs' examination, refrigeration practice and the science and technology of refrigeration.

Speaking at the meeting, Dr. W. T. Prideaux said that there were now 700 students in the Imperial College (of which the City & Guilds College is a part) as compared with 545 a year earlier and 477 in the previous year.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Telephone Properties, Ltd.—In a statement issued with the annual report Sir Alexander Roger, the chairman, says that income at £83,778 for the year ended December 31st. last compares with £84,467 in the previous year. Largely because of big purchases of telephone material for Venezuela, there have been changes in the loan position between their company, the Telephone & General Trust (the controlling company) and the Nacional Telephone Co. of Venezuela. Demand for telephone service continues to grow and outstrip all new additions and in face of many difficulties they were able to dispatch in 1946 to Venezuela over £200,000 worth of British plant and equipment. The net profit was £34,320 (£29,935) and, after maintaining the ordinary dividend at 6 per cent, £45,899 (£43,835) was carried forward.

Parmiter, Hope & Sugden, Ltd.—Speaking at the annual general meeting, Mr. Vernon Hope, the chairman, said that during an extensive tour of Australia, New Zealand and South Africa he had found no sign of the present sellers' market diminishing so far as the company's type of gear was concerned and there was a very great demand for their products which unfortunately could not be met owing to Government controls preventing the production of goods for export almost entirely. They had an unprecedented value and number of orders in hand and the output for the past year exceeded the previous highest figure by a considerable amount. Extensions were being carried out so that they would be ready to push ahead when the present restrictions were removed.

Telephone Manufacturing Co., Ltd.—The trading results of this company were given in our issue of August 1st. Explaining the fall from £272,495 to £21,783 in the net profit, the company states that this is due to the decrease in output resulting from the cancellation of wartime contracts and to the difficulties inherent in changing over to the manufacture of the company's normal products. In spite of the increasing difficulty in obtaining raw material and labour, the output has now reached a profitable level. All the subsidiaries traded at a profit.

Lisbon Electric Tramways, Ltd.—In a statement presented at the recent annual general meeting, Sir Alexander Roger, the chairman, says that the provision of improved transport facilities for the city of Lisbon has continued to be their first preoccupation and in spite of constant and concentrated pressure in Portugal, Britain, the United States and other countries delays in deliveries of supplies, many of which were ordered in 1946, have prevented improvement and expansion on the ample scale which is planned. The number of passengers carried on the trams and elevator increased by nearly 23,000,000 to the record number of 250,765,722.

Christy Brothers & Co., Ltd.—At the annual general meeting Mr. Frank Christy, the chairman, said that, although difficulties still remained, he was able to report a very satisfactory result of the year's trading. It was still uncertain how the nationalization of the electricity supply industry would affect the company but the cautious policy adopted should provide the surest safeguard if its business had to be substantially adjusted as a result of the Government's policy.

Ericsson Telephones, Ltd.—The list opened on Tuesday last for an issue of £1,000,000 3½ per cent first mortgage debenture stock 1965/1975 at par, redeemable at 101. The issue, which is being made under the auspices of the Ocean Trust Co., Ltd., is being underwritten for 1 per cent. The object of the issue is to fund the major part of the company's borrowings from its bankers and redeem forthwith the £50,000 5 per cent first mortgage bonds partly securing the borrowings.

The Nico Light Engineering Co., Ltd., reports a profit for the year ended March 31st last of £9,164, as compared with £4,695 for 1945-46, to which is added £5,483 brought in, making £14,647. Reserve receives £3,000 and it is proposed to pay a dividend of 10 per cent and a bonus of 5 per cent, less tax, making 15 per cent for the year (against 12½ per cent). The balance carried forward is £7,182.

Bylock Electric, Ltd., is to pay an interim dividend of 100 per cent. When the company was made public in June last it was stated that unless unforeseen circumstances arose the directors intended to recommend in due course a final dividend of 200 per cent, making 300 per cent. No dividend was paid for 1945-46.

The Pirelli-General Cable Works, Ltd., is to pay a dividend of 8 per cent (same), together with a bonus of 12 per cent (4 per cent). The net profit, after taxation, was £339,688 for the year ended March 31st, as compared with £91,052 in the preceding year.

The Victoria Falls & Transvaal Power Co., Ltd., is paying a final ordinary dividend of 15 per cent, making 19½ per cent for 1946 (against 19 per cent for 1945).

The Lancashire United Transport & Power Co., Ltd., announces its intention to redeem the whole of the outstanding first mortgage debenture stock at 102 per cent on November 29th.

Waste Heat & Gas Electrical Generating Stations, Ltd., has declared an interim dividend of 2½ per cent (unchanged).

The Northmet Power Co. has declared an interim dividend of 3 per cent.

The British Oxygen Co. is paying an unchanged interim ordinary dividend of 8 per cent.

The English Electric Co., Ltd., is again paying an interim ordinary dividend of 4 per cent.

New Companies

Electrical & Musical Industries (China), Ltd.—Registered August 11th. Capital, £150,000. To acquire the business carried on by Electric & Musical Industries (China), Ltd. (in liquidation), and to carry on the business of makers of, and dealers in, machines and instruments for musical entertainment, instructive, scientific and other purposes, gramophones, records and cinematographs, electrical and general engineers, etc. Directors: Sir Alexander Aikman, Sir Ernest Fisk, H. L. Wilson, R. J. Degoy, L. J. Brown, G. J. Manning, and D. J. Benson. Regd. office: Gramophone Buildings, Blyth Road, Hayes, Middlesex.

Girdlestone & Co., Ltd.—Private company. Registered August 9th. Capital, £10,000. Electrical engineers, etc. Directors: W. Riggs, T. C. Riggs, P. H. Riggs, G. F. Bedford and G. C. A. Mann. Regd. office: 23, Davies Street, W.1.

Girdlestone Refrigeration, Ltd.—Registered August 9th. Capital, £10,000. Electrical engineers, etc. Directors and other particulars are similar to those of Girdlestone & Co., Ltd. (above).

Merco (Scotland), Ltd.—Registered in Edinburgh July 29th. Capital, £1,000. Radio and electrical equipment manufacturers, etc. Directors: S. W. Cohen and J. Merrens. Regd. office: 20, King Street, Glasgow.

Technical Porcelain, Ltd.—Registered July 31st. Capital, £500. Importers, exporters and manufacturers of, and dealers in, all kinds of technical porcelain, steatite and ceramics, electrical, television and wireless apparatus, etc. Subscribers: H. W. Dewick and Marjorie E. Dewick. Regd. office: 52, Shaftesbury Avenue, W.1.

J. A. Higgs (Electrical), Ltd.—Registered July 30th. Capital, £500. Manufacturers and repairers of, and dealers in, dynamos, motors, armatures, magnetos, etc. Directors: J. A. Higgs and Ellen E. Higgs. Regd. office: 83, Forest Street, E.7.

Norman Helm, Ltd.—Registered July 30th. Capital, £4,000. To acquire the business of a radio dealer, electrical contractor, etc., carried on by N. Helm at 10, Silver Street, Bury. Directors: N. Helm and Hannah Helm. Regd. office: 10, Silver Street, Bury.

Arc Installations, Ltd.—Registered August 2nd. Capital, £1,000. Electricians, electrical engineers, etc. Directors: A. L. R. Walton and Betty A. Portch. Regd. office: 1, Guildhall Chambers, Basinghall Street, E.C.2.

A. Mourton (Electrical), Ltd.—Registered August 5th. Capital, £1,000. To acquire the business of an electrical engineer and contractor carried on at 58, Tooting Bec Road, S.W.17, as A. Mourton. Directors: A. A. J. Mourton and Mrs. I. Mourton. Regd. office: 58, Tooting Beck Road, S.W.17.

Langham Radio & Electrical Co., Ltd.—Registered August 5th. Capital, £100. Arnold Fine, 7, Cavendish Place, W.1, is the first director. Regd. office: 7/11, Cavendish Place, Regent Street, W.1.

North Hants Radio & Electrical Co., Ltd.—Registered July 29th. Capital, £500. Directors: N. E. Budd and J. T. Goss. Regd. office: Plough Corner, Yateley, Camberley, Surrey.

Kilgour Radio & Electrical Services, Ltd.—Registered in Edinburgh July 21st. Capital, £100. Directors: J. McNeill, E. T. M. Kilgour, and S. C. Ellis. Regd. office: 1125, Aikenhead Road, Glasgow, S.4.

Heatric, Ltd.—Registered August 7th. Capital, £1,000. Manufacturers of, and dealers in, electrical goods, etc. Directors: H. N. Standbridge and Elsie M. Standbridge. Regd. office: 20, Stoneleigh Avenue, Coventry.

F. Athey & Co., Ltd.—Registered August 7th. Capital, £3,000. To acquire the business of electrical and radio engineers and dealers, etc., carried on by F. Athey & Co., at Winsford; also to carry on the business of manufacturers of, and dealers in, toys powered by midget electric motors, etc. Directors: F. Athey, Mrs. C. E. Athey and G. Fitton. Regd. office: 173, High Street, Winsford, Cheshire.

Paramount Supplies (Manchester), Ltd.—Registered August 8th. Capital, £500. Electrical equipment specialists, etc. Directors: Mrs. Amelia Becker and I. Binks. Regd. office: 430, Cheetham Hill Road, Manchester.

Increases of Capital

Gent & Co., Ltd.—Capital increased by £30,000 beyond the registered capital of £70,000.

Southern United Telephone Cables, Ltd.—Capital increased by £425,000 beyond the registered capital of £75,000.

Stamford Electrical, Ltd.—Capital increased by £20,000 beyond the registered capital of £20,000.

George H. Scholes & Co., Ltd.—Capital increased by £50,000 beyond the registered capital of £8,500. (The capital, as reorganized, is now £58,500 in 50,000 6 per cent redeemable cumulative preference and 8,500 ordinary shares of £1.)

Liquidations

Electrical Credit Services, Ltd. — Meeting September 12th at the offices of John Mathie & Co., Abbey House, Baker Street, London, N.W.1, to receive an account of the winding-up by the liquidator, Mr. F. Neal.

STOCKS AND SHARES

STOCK Exchange markets and prices continue in a very unsettled condition. During the past few business days, Consols fell to the lowest price touched for three years, and this had its natural effect upon all investment securities, although, logically, weakness in British Government securities should make for improvement in the prices of those stocks and shares which come within the nationalization plan. After a violent shake-out, prices rallied to a slight extent, and the sentiment round the markets, which previously had been one of unpleasant nervousness, gave way to a more philosophic disposition. The selling ceased and a few bargain-hunting buyers appeared, the net result being that while prices are substantially lower than they were in the middle of July, they are not quite so flat as those which obtained at one time during the second week of August.

This Week's Changes

Prices in the industrial markets have been marked down far enough to discourage selling on the scale previously encountered ; but the continuance of scattered sales met little resistance. Electrical equipment ordinary shares have suffered again, along with all other sections of the market. Johnson & Phillips lost 5s. at 70s., and declines of a florin to half-a-crown are shown by Telegraph Constructions, 47s., English Electric, 55s. 9d., Enfield Cables, 41s. 3d., General Cables, 47s. 6d. and Westinghouse Brakes, 65s. Reyrolles have eased further to 72s. 6d., Chloride Electrical to 5⅓ and Siemens to 32s. 6d. In the telephone group, H.T.A. are lower at 17s. 6d. and Ericssons at 42s. 6d. The last-named company's issue of 3½ per cent debentures at par encountered market conditions that could hardly be considered favourable at the time of the prospectus publication.

Extent of the Slump

Markets displayed the first signs of weakness in the middle of July. Tables last week in this column illustrated the decline of prices over the year to date. The following gives an indication of the extent of the damage which has been done to security prices in the course of a month, and shows also the year's best prices :—

Stock or Share	July 18	Aug. 15	Fall	Highest 1947
2½% Consols ..	90¾	83⅜	7⅜	99
G.E.C. 6½% Pref.	38/–	33/9	4/3	41/9
G.E.C. Ord. ..	95/6	85/9	9/9	103/9
A.E.I. Ord. ..	92/3	80/9	11/6	92/6
Automatic Tel. Ord.	68/6	60/–	8/6	83/–
B.I.C. Ord. ..	44/6	40/–	4/6	52/3
E.M.I. Ord. ..	24/9	21/9	3/–	29/6
Co. London Elec. Ord.	46/6	45/–	1/6	49/–
Southern Rly. Pref.	117½	114½	3	123¾
Babcock & Wilcox	77/–	67/–	10/–	82/6
Tube Investments	7⅛	6⅞	15/–	7⅛

Miscellaneous Movements

Speculative interest has kept Cable & Wireless stocks on the move. The preference has lost 1½ points this week, to 114½, but the ordinary shows no net change. A number of small improvements in electricity supply shares reflect the influences which have been at work more noticeably in the Home Railway market. Bournemouth & Poole Electric, at 61s., have gained 1s. De la Rue have shed a further 5s. to 47s. 6d : the quotation was over £3 a few weeks ago. A drop of 10 points to 127½ in Anglo-American Telegraph preferred is a rather extreme example of the way in which the prices of fixed-interest stocks as a whole are being adjusted to the new gilt-edged standards. London Electric Transport 2½ per cent debenture, at 94½, are 6 points down on the week.

Nationalized Stocks

Price improvements in the Home Railway market witness a better appreciation of the short-term advantages peculiar to stocks scheduled for nationalization. Brokers have been reporting difficulty in making to stockholders the point that a relapse of gilt-edged prices prior to the take-over does them, the stockholders, no further harm. To the extent that it implies a higher rate of interest on the compensation stock and, therefore, a smaller loss of income than was originally expected, the decline of gilt-edged securities to a 3 per cent basis could be interpreted as some alleviation of their misfortune. Failure to recognize this point is put down to incredulity that any good thing could emerge for stockholders from the transport or electricity proposals. But the market slump has brought out the advantage of holding stocks that possess a fixed compensation value based on prices ruling either last November or before the General Election.

Sell or Retain ?

From the first introduction of the Bills, holders of Home electricity supply and railway securities have faced a temptation to sell their holdings at levels below the compensation prices, with the object of anticipating the prospective loss of income at the time of the take-over. Many holders adopted this course, reinvesting on an equal yield basis in other markets. Success of this policy depended, of course, on the assumption that conditions for reinvestment would become increasingly unfavourable with the approach of the vesting dates. Other holders, with equally little intention of accepting permanently the lower income from a Government stock, but with opposite market views, have been retaining their interest, and accepting the possibility of a serious discount on the compensation stocks when dealings begin. In most cases, the retainers are now coming out on top. They can also view, with relative equanimity, the obscurity of market conditions over the rest of a difficult year.

NEW BOOKS

Radio Textbook. Modern Materials Handling.

Second Year Radio Technology. By W. H. Date, B.Sc., A.M.I.E.E. Pp. 222; figs. 155; index. Longmans, Green & Co., 43, Albert Drive, London, S.W.19. Price 7s. 6d.

No matter what the subject may be, there is one serious difficulty which confronts the author of any elementary textbook. How can he be accurate and, at the same time, ensure that clarity of expression which is essential if the beginner is to understand him? All too often the author compromises and in the interest of clarity makes statements which appear as unconditional statements of fact when in reality they are, at best, approximations to the truth and of reasonable accuracy only when certain conditions are fulfilled. Unfortunately, the beginner does not recognize this and is often seriously misled, with the result that later in his career he has to unlearn much of his early training.

The author of this book has avoided the worst mistakes of this kind and his treatment is, on the whole, adequate. He assumes the student to understand the basic principles of electricity and magnetism and starts with a discussion of capacitance, inductance and resonant circuits. Radiation and valves, as detectors, amplifiers and oscillators, are treated of and there are chapters on direction finding, superheterodyne reception and r.f. measuring instruments.

The discussion of the bandwidth of coupled circuits is rather misleading because the effect of circuit resistance is ignored and the bandwidth is taken as the peak separation. This is a definition of bandwidth rarely used in practice.

It is unfortunate that there are also some errors of fact in the description of aerial coupling circuits. When referring to an aerial inductively loaded to give series resonance at the desired frequency, he says "If the circuit has a high Q factor the impedance offered to neighbouring unwanted frequencies will be high and interfering currents from these stations will be small." In such a circuit, of course, the impedance away from resonance is nearly independent of Q and selectivity is increased by a high Q not because the current at unwanted frequencies is reduced, but because that at the wanted frequency is increased.

In the case of the aerial connected directly to a parallel tuned circuit he says "The magnified voltage is tapped off across the coil and is given by Q times the e.m.f. induced in the aerial." It is easy to show that it is $Q\frac{C_a}{C+C_a}$ times the induced e.m.f., where C_a and C are the aerial and tuning capacitances respectively.

When the author comes to the common practical circuit in which a coupling coil connected to aerial and earth is coupled to the tuned circuit he makes some surprising statements. "The effect of the capacitance of the aerial on the tuning circuit is obviated . . ." and "The resistance of the tuning circuit now consists of that of the coil . . ."

Had he used the word "reduced" instead of "obviated" in the first statement one could hardly disagree with it. It is well known, however, that both the reactance and resistance of the aerial circuit are transferred to the secondary in a degree dependent on the amount of coupling and can never be zero.—W.T.C.

Materials-Handling Equipment. By M. W. Potts. Pp. 172; figs. 95 with index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 17s. 6d.

This small American manual is attractively printed. It is an historical introduction to the subject, covering essentials rather than specialized examples, without entering into detailed technicalities. Each variant within several classes (conveyors, elevators, hoisting devices; trucks, stackers, tractors, trailers; miscellaneous) is defined, described and its most common uses indicated, all very briefly and quite clearly; contractors' plant and industrial processing machinery are intentionally omitted.

The book is a compilation from a series of the author's articles published elsewhere; it differs from ordinary textbooks and those which extensively detail specific equipment in that it explains "standard" types and usual applications rather than the unusual. It is thus a guide to principles that will not change, even though adaptation and refinement may be introduced, and is likely to aid differentiation for selection in spite of the confusion brought about by variation of trade names for the same pieces of equipment.—W.O.F.

Trade Marks and Unfair Competition and **Patents and Registered Designs,** by T. A. Blanco White. Stevens & Sons, Ltd., 119 and 120, Chancery Lane, London, W.C.2. Price 4s. net each.

These are two new additions to the "This is the Law" series. In the volume dealing with trade marks the author deals among other points with protection given by the registration of trade marks, how to register a trade mark, pitfalls in trade-mark law and slander of goods. The volume on patents and registered designs explains how, when a new line of goods is put on to the market, the law can be used to prevent the imitation of those goods by competitors. It tells how to apply for a patent and has useful chapters on patenting of important inventions, the registration of designs, artistic copyright, monopolies, and wartime arrangements.—H.B.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Electronic Burglar Alarm

THE "Osilo" burglar alarm system, which can if desired be made to operate by the mere presence of a person in the proximity of the area or article protected, has just been introduced by ELECTRIC TIME RENTALS, LTD., Winchester House, Old Broad Street, London, E.C.2. Normally the apparatus is adjusted to operate when windows, safes, etc., are actually touched.

The thermionic valve relay unit which sets off the alarm is operated by the capacity effect of the person approaching or touching the articles protected. A self-contained power supply provides a safeguard against failure of the mains supply, while any interference with either the control unit or source of power causes the alarm to be given.

Electric Blanket

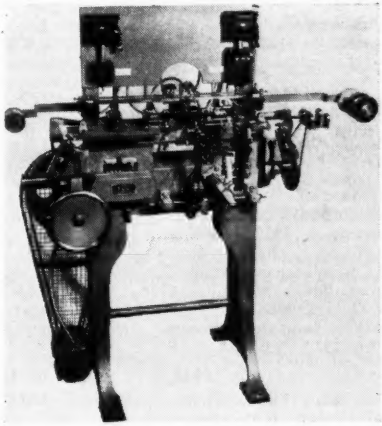
A bed-warming blanket of the low-voltage a.c. type is being produced by "MINIPOT" APPLIANCES, LTD., 35, Vittoria Street, Birmingham, 1. It is energized through a step-down mains transformer, double wound and continuously rated, which is tapped for three-heat regulation without using a thermostat. Thus the outputs for the household blanket are 30, 45 and 65 W while those for the hospital type are 50, 85 and 150 W, the secondary voltages never exceeding 14 and 18 V respectively. The bakelite connector plug is non-universal, so minimizing the risk of its accidental insertion directly into a mains socket. This blanket may be folded and, it is claimed, repeatedly washed without risk of harming the heating element.

Lamp-making Equipment

Hitherto most of the electric lamp manufacturing machinery used in this country has been imported from America and Germany. Now, however, the E.V.D. ENGINEERING CO., LTD., Belvedere Works, Cotswold Street, West Norwood, S.E.27, and its associate, the DORSET ENGINEERING CO., 108a, Drummond Street, N.W.1, are specializing in the manufacture of apparatus of this class.

One new E.V.D. machine is for welding together the three strips of different metals which compose the leading-in wires. Pieces of nickel and copper wire automatically straightened and cut to the correct length are held in position while a small piece of special bimetal wire with the same coefficient of expansion as glass, also cut to exact size, is inserted between them and welded by means of a gas flame. After welding, a hook is formed on the end of the nickel wire for mounting the filament. The leads are produced at the rate of forty-two a minute and the whole operation is entirely automatic, the various operations being controlled by means of a series of cams actuating solenoids which in turn operate the wire feeding, cutting, holding and welding mechanism. A ½-h.p. motor drives the unit, a 110-V d.c. supply being required to operate the solenoids.

A machine for making the more complicated



E.V.D. machine for making the leading-in wires for lamps

leading-in wires for coiled-coil lamps is also being developed. These wires have four components, a fuse being also incorporated. A new type of filament spiral making machine has been brought out by the Dorset Engineering Co.

Boiling Plate

The latest addition to the range of "Reelek" household appliances of REEVES ELECTRICAL & RADIO CO., LTD., Reelek Works, Baldock, Herts, is a boiling plate of 6½ in. diameter with a 1-kW enclosed element. The die-cast housing is 8½ in. square and 2½ in. high with a polished top and sides in pastel shades.

Grease Removal

A concentrated degreasing liquid which, when in solution with water, will remove dirt, grease and wax films is available from S. B. JACKSON, LTD., Windsor House, Victoria Street, London, S.W.1. This derivative of sulphonated hydrocarbons named "Degrosol" is free from alkalis and acids. It can be used for cleaning switchgear, control panels, oily floors and for dishwashing in canteens. As a "wetting" agent, the addition of 0·2 per cent to water suffices substantially to reduce surface tension.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

1939

H. HUGHES & Son, Ltd., D. O. Sproule and A. J. Hughes.—" Installations for emitting sound waves and receiving the echoes thereof." 11228. April 13th, 1939. (590938.)

1941

General Electric Co., Ltd., and E. C. Davies.—" Brush-holder arrangements for dynamo-electric machines." 5128. April 21st, 1941. (590770.)

1943

Marconi's Wireless Telegraph Co., Ltd., E. Green and V. J. Cooper.—" Directional aerial systems." 9852. June 18th, 1943. (590772.)

British Thomson-Houston Co., Ltd.—" Cation-exchange resins for removing cations from liquid media." 16776. October 15th, 1942. (590883.) " Methods of removing cations from liquid media." 16777. October 15th, 1942. (590884.)

1944

British Thomson-Houston Co., Ltd.—" Frequency responsive means particularly for use with frequency modulated radio transmitters." 3258. February 27th, 1943. (590886.) " Methods of activating cathodes of electric discharge devices." 12082. June 26th, 1943. (590894.)

Standard Telephones & Cables, Ltd.—" Electron discharge devices." 8594. January 22nd, 1942. (590777.)

E. G. Budd Manufacturing Co.—" Control of a.c. circuits subject to line voltage variation." 9126. April 19th, 1943. (590892.)

Western Electric Co., Inc.—" Electron discharge devices." 9760. May 27th, 1943. (590779.)

General Electric Co., Ltd., and D. C. Espley.—" Electron discharge valve amplifiers for pulses." 10954. June 7th, 1944. (590781.)

General Electric Co., Ltd., and G. Ellis.—" Alternating current electric ship propulsion systems." 13319. July 12th, 1944. (590787.)

Marconi's Wireless Telegraph Co., Ltd.—" Means for comparing the frequencies of electric oscillations." 16373. August 27th, 1943. (590901.)

G. N. Haden & Sons, Ltd., and H. H. Bruce.—" Vertical storage water heaters." 16613. August 31st, 1944. (590790.)

General Electric Co., Ltd., and E. B. Power.—" Electric discharge lamps." 17826. September 18th, 1944. (Addition to 579826.) (590903.)

Western Electric Co., Inc.—" Electrical signalling systems." 18180. October 5th, 1943. (590944.)

1945

British Arca Regulators, Ltd., and T. Lindsay.—" Boiler feed pressure regulators and the like." 880. January 10th, 1945. (590832.)

L. A. Mann.—" Illuminated signs and the like." 993. January 12th, 1945. (590833.)

Crypton Equipment, Ltd., and E. J. Gratex.—" Devices for measuring mechanical forces more particularly for torque testing purposes and equipments incorporating such devices." 1517. January 18th, 1945. (590911.)

Simplex Electric Co., Ltd., and A. V. Barton.—" Control means for electrically heated appliances." 1766. January 23rd, 1945. (590835.)

Turners Asbestos Cement Co., Ltd.—" Manufacture of electrical insulating boards or slabs." 3340. February 16th, 1944. (590804.)

Metropolitan Electric Supply Co., Ltd., and H. F. Watson.—" Cooking stoves." 4169. February 19th, 1945. (590837.)

F. W. Rutter.—" Electric terminal connectors." 7483. March 24th, 1945. (590810.)

Marconi's Wireless Telegraph Co., Ltd., and J. Stewart.—" Automatic tone controlling circuit arrangement for radio or like systems." 9993. April 20th, 1945. (590824.)

Igranic Electric Co., Ltd.—" Measurement of interchangeability of combustible gases." 10279. April 24th, 1944. (590864.) " Control of polyphase alternating current motors." 10864. April 28th, 1944. (590982.)

H. W. K. Jennings (First Industrial Corporation).—"Snap action electric switches." 10310. April 24th, 1945. (590870.)

R. E. Forrester.—" Electrical plug or socket connections." 10363. April 25th, 1945. (590873.)

R. C. Mildner.—" Manufacture of electric cables." 10385. April 25th, 1945. (590875.)

British Thomson-Houston Co., Ltd.—" Gas turbine nozzles." 10408. April 26th, 1944. (590878.)

A. V. Roe & Co., Ltd., and R. F. Taylor.—" Welding electrodes." 10419. April 25th, 1945. (Addition to 544176.) (590880.)

Pirelli-General Cable Works, Ltd., and H. Barron.—" Manufacture of coils or windings formed from electrically insulated wires." 10477. April 26th, 1945. (590966.)

A. Reyrolle & Co., Ltd., and A. Felce.—" Electric air-break circuit-breakers." 10519. April 26th, 1945. (590970.)

Express Lift Co., Ltd., and W. A. Dixie.—" Lifts." 10654. April 27th, 1945. (590976.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—October 6th. Western Australian Government Tender Board, Perth. Transformers (Sch. 225 A. 1947); 22-kV metalclad and 66-kV outdoor switchgear (Sch. 226 A, 1947); 22-kV metalclad switchgear (Sch. 227A, 1947); and 3-kV switchgear (Sch. 228 A, 1947).

Crayford. — September 8th. U.D.C. Fluorescent lighting in Town Hall offices. (See this issue.)

Edinburgh. — North of Scotland Hydro-Electric Board. 132-kV transmission lines. (See this issue.)

Hull.—August 29th. Electricity Department. Diesel-driven loco shunting crane. (August 15th.)

Keighley. — September 6th. Electricity Department. Transformers. (See this issue.)

Middlesbrough.—September 19th. Electricity Department. Transformers, circuit breaker and oil break isolators and substation type distribution feeder panels. (August 15th.)

Newport (Mon.).—August 29th. Corporation. Electrical installations in houses on the Gaer Estate. (August 15th.)

New Zealand.—October 31st. South Canterbury Power Board, Timaru. Peak-load control and metering gear, by superimposed ripple-frequency system or otherwise.

November 4th. Hydro-Electric Department. Turbines and generators for Cobb River power station (Contract 37) and electric travelling crane and motors (Contract 38). Tenders Committee, Wellington.

Portsmouth.—September 30th. Electricity Service. Transformers. (See this issue.)

Sheffield.—September 2nd. Electricity Department. Transformers. (See this issue.)

Shrewsbury. — September 1st. Housing Committee. Re-wiring thirty-eight houses at Harlescott Close. Particulars from the borough surveyor.

Stoke-on-Trent.—September 10th. Electricity Department. Four 15,000-kVA transformers. (August 8th.)

Weymouth & Melcombe Regis.—September 27th. Electricity Department. Transformers. (See this issue.)

Orders Placed

Durham.—County Council. Accepted. Electrical installation in police houses at Houghton-le-Spring (£666).—J. T. Purvis. Electrical installation at police houses at Chester-le-Street (£360).—Steel's Engineering Installation.

Northumberland. — County Council. Accepted. Additions to the electrical installation at Hepscott Manor, Morpeth (£159).—F. Chicken. Alterations to the lighting installation at the County Hall (£398).—Robson & Coleman.

West Hartlepool.—Corporation. Accepted. 5,000-kVA transformer for Mulgrave Road substation (£2,930).—Bryce Electric Construction Co.

Worthing.—Electricity Committee. Recommended. One 8-unit truck-type cubicle switchboard for service on 11-kV system (£2,135).—Crompton Parkinson. One twelve-way l.v. substation switchboard (£597).—G. P. Dennis.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeenshire.—Police stations at Boddam and Pitcable; county architect, County Buildings, Aberdeen.

Bath.—Adaptations at Corsham Court, for Academy of Art students (£31,200); city engineer, Guildhall.

Bethnal Green.—Flats (31), Scepter Street estate, for Sutton Dwellings Trust; V. Wilkins, 12, York Buildings, Adelphi, W.C.2.

Brighton.—Coach building and motor engineering works, Hollingbury; Nicholls & Co. (Brighton), Ltd., 100, North Road.

Cambridge. — Junior and infants' school, Trumpington; borough engineer and surveyor, Guildhall.

Cardiff.—Block of offices, Kingsway; Prudential Assurance Co., Ltd. (Surveyor's Dept.), Holborn Bars, E.C.1.

Carlton (Notts).—Houses (34) on two sites; U.D.C. Surveyor, Council House, Burton Road.

Chatham.—Rebuilding laundry, Maidstone Road; Truett & Steel, Ltd., 71, High Street, Thornton Heath.

Chelsea.—Cold store and loading dock, supply depot, Ives Street; Express Dairy Co., Ltd., 15, Tavistock Place, W.C.1.

Chislehurst.—Dwellings (750), St. Paul's Cray, for L.C.C.; Holland & Hannen & Cubitts, Ltd., contractors, 1, Queen Anne's Gate, London, S.W.1.

Chiswick.—Flats (60), and estate office, Edensor Gardens; borough engineer, Town Hall, W.4.

Clapham.—Flats (70), King's Avenue, for L.C.C.; A. L. Abbott, 5, Buckingham Place, S.W.1.

Croydon.—Office block, Morebank Lane, Waddon; G. M. Carter (Erectors) Ltd., 7, Victoria Street, S.W.1.

Dagenham.—Extensions to works, for May & Baker, Ltd.; Edward D. Mills, 127, Cheapside, E.C.2.

Darlington.—Staff houses on ten-acre site, north of Broadway; Paton and Baldwins, Ltd.

Dolgelley. — Temporary offices, Penarlag; county architect, County Offices.

Eastbourne.—Conversion to flats, Beltry Court, Devonshire Place (£16,330); H. Hubbard Ford, 24, Cornfield Road.

Egham.—Extensions to works, for Paripan Ltd.; Herbert J. Stribling, Highfield, Bath Road, Slough.

Enfield.—Extensions to works, Stockingswater Lane, Brimsdown; Ruberoid Co., Ltd., Commonwealth House, New Oxford Street, W.C.1.

Epsom & Ewell.—Houses (76), near Worcester Park brickworks (£92,188); New Ideal Homesteads, Ltd., Railway Approach, Sidcup.

Forest Gate.—Extensions to works for Robertson & Woodcock, Ltd., Katherine Road; Higgins & Thomerson, 76, Finsbury Pavement, E.C.2.

Graffham (Sussex).—Omnibus garage; Hants & Sussex Motor Services Ltd., South Leigh Road, Emsworth, Hants.

Great Yarmouth.—Two blocks of shops with flats above, Shrublands Estate; H. F. Dyson, borough engineer, 15, Regent Street.

Guildford. — County police headquarters, junction of By-pass Road and London Road; county architect, County Hall, Kingston-on-Thames.

Ilkeston.—Works, Cotmanhay Road; Eros Wings, Ltd., Lindsay Street, Hyson Green, Nottingham.

Kingston.—New factory for Euco Tools, Ltd., 44, London Road.

Lancaster.—Traditional houses (130); city engineer.

Nottingham.—Houses (38), Strelley Road (£50,525), and (32) Chingford Road (£43,150); borough engineer.

Oldbury.—Flats (40), in ten blocks; T. Dunkley Hogg, architect, 1, Church Street.

Perthshire.—Additions at Breadalbane Academy, Aberfeldy (£10,000); county architect, Perth.

Plymouth.—Rebuilding factory; British Glues & Chemicals, Ltd., Lomas Gelatine Works, Cattedown Road.

Port Dinorwic.—New bacon factory for T. Roberts & Sons, Ltd., Parciau.

Richmond (Yorks).—Permanent houses (64), Gilling Road; Needham and Thorpe, architects to T.C., 6, High Petergate, York.

St. Albans.—Extensions to High School for Girls; R. Fielding Dodd, Best & Stevens, 21, Turl Street, Oxford.

Salford.—Domestic science block and canteen with alterations to main building, Leicester Road Modern School for Girls; city engineer, Town Hall.

Sedgley.—Houses (56), Ettymore Road South; McKewan, Fillmore & McKewan, 8, Newhall Street, Birmingham.

Sherburn.—Factory for the North Eastern Trading Estates; Hadden & Hillman, 127, New Bridge Street, Newcastle-on-Tyne.

Solihull.—Junior schools, Hatchford Brook and Ulverley; A. C. Bunch, county architect, Shire Hall, Warwick.

Southend-on-Sea. — New £120,000 primary school at Prince Avenue; Hosking & Son (Essex), Ltd., builders, Arterial Road, Rayleigh.

Southwark.—Rebuilding paper printing works, Southwark Grove; Metal Box Co., Ltd., 28, Cavendish Square, W.1.

Stoke-on-Trent.—Research laboratories for British Pottery Research Association; Wood, Goldstraw & Yorath, Tunstall.

Streatley. — Wireless transmitter building, cable runways, etc., for Bedfordshire Standing Joint Committee; J. B. Graham, clerk to Committee, Shire Hall, Bedford.

Sunderland.—Brass foundry for the Sunderland Forge & Engineering Co., Ltd. (£4,000).

Tipton.—Extensions to foundry, Albion Street; Chatwins, Ltd., Sunbeam Grate Works.

Tooting.—Flats (505) and shops (27), Chetwode Road, for Wandsworth B.C.; R. G. Covell, 5, Mitcham Road, S.W.17.

Ulverston.—Works, Morecambe Road, Ashley Accessories, Ltd.; Dixon Hill & Co., 52, Union Street, Oldham.

Welwyn Garden City.—Laboratories for I.C.I., Ltd., Black Fan Road; Welwyn Builders, Ltd.

West Bromwich.—Works, Friar Park Road, Smith & Davies, Ltd., Walsall Street; John W. Wilson, 48, High Street, Sutton Coldfield.

Extensions, Excelsior Works, Pugh Street; Walsall Conduits, Ltd.

Whitley Bay.—Houses (42) on the Seatonville estate for the U.D.C.; R. S. Appleby, builder, Clayton Street, Newcastle-on-Tyne.

Willand.—County primary school (£18,370), for Devon C C ; M. T. Sleeman and Sons, builders, Exeter.

Winchmore Hill.—Additions to Grassendale Works, Orpington Road; Elliott, Cox & Partners, 172, Buckingham Palace Road, S.W.1.

Workington.—Factories for Novalam Furs, Ltd., and A.S.P. Chemicals, Ltd.; West Cumberland Industrial Development Co., Ltd., 30, Roper Street, Whitehaven.